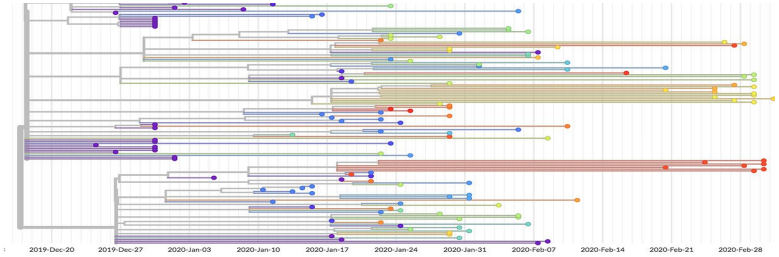
COVID-19 Infographic Project

Eman, Anna, Isabel, Ariella, Libby

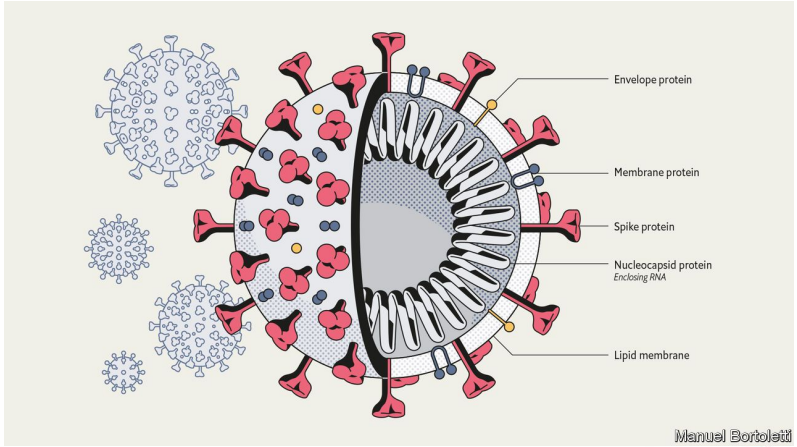
Mutations in the Spike Protein

One of the main points of concern with coronavirus is the likelihood of it mutating into something more aggressive and fatal. The virus has already undergone a few mutations, that have sorted it into two main types: 30% of cases belong to the S group, 70% belong to the L group. Moving forward, when studying mutations, scientists are paying attention to one specific part of the cell: the spike protein.



Why is the spike protein important to study?

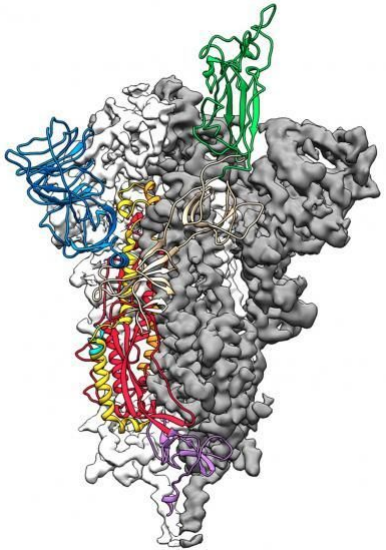
1. A mutation in the spike protein that would make it easier for COVID-19 to break into human cells would be the next step in increasing the contagiousness of this virus.
2. If scientists can find a way to target this spike protein and make it inactive, that can be used for a vaccine/treatment.



Spike Protein Information

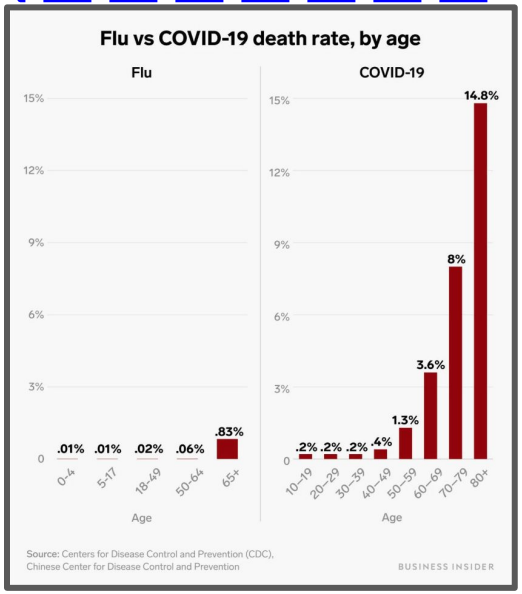
After analyzing the genome of COVID-19, scientists found that the reason coronavirus is so contagious lies in the evolutionary development of its spike protein. (overall cell diagram above, spike protein model on right). The spike protein has two major components:

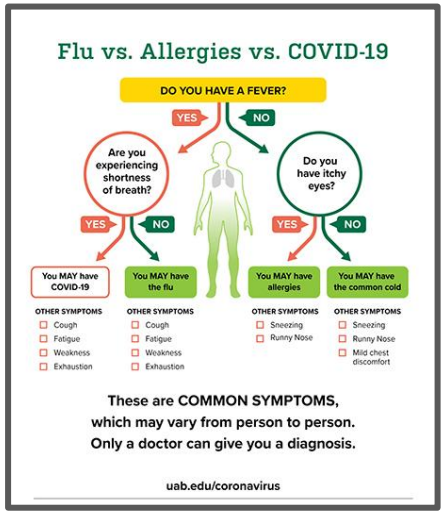
1. The receptor binding domain (hooks onto the host cell)
2. Cleavage site (breaks into the host cell)



Covid-19 vs the flu

A big misconception about the comparison between these two viruses is that the flu has killed more people, and therefore is worse than Covid 19. However, this graph of the death rates of quickly show how much more severe Covid-19 is.



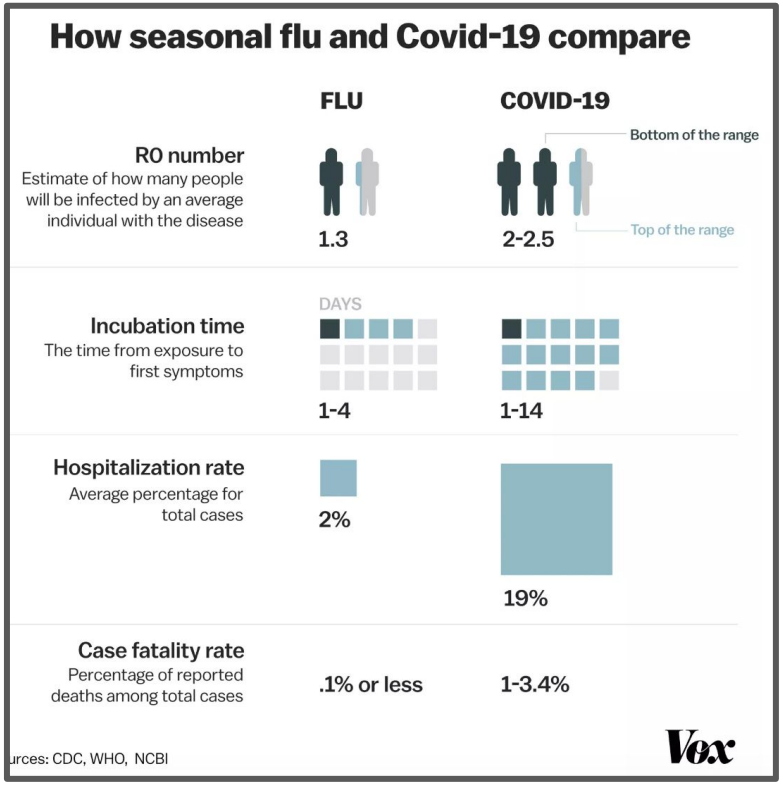


Covid-19 spreads much quicker than the flu because of its infection rate that's double the flu's infection rate.

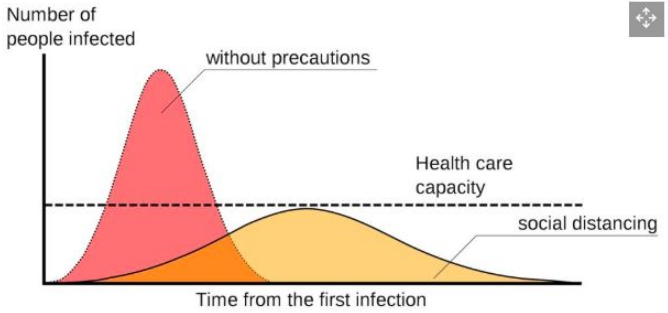
An important differentiating factor between Covid-19 and the flu is the hospitalization rate; though many people who get Covid-19 may not die, an unusually large portion will need to be hospitalized, which will require more resources, like ventilators, than the flu requires.

According to the CDC, the main symptoms of Covid-19 are fever, cough and shortness of breath, and the main symptoms of the flu are fever, cough, sore throat, stuffy nose and muscle/body/headaches.

Ariella



What does “flattening the curve” mean and why is it important?

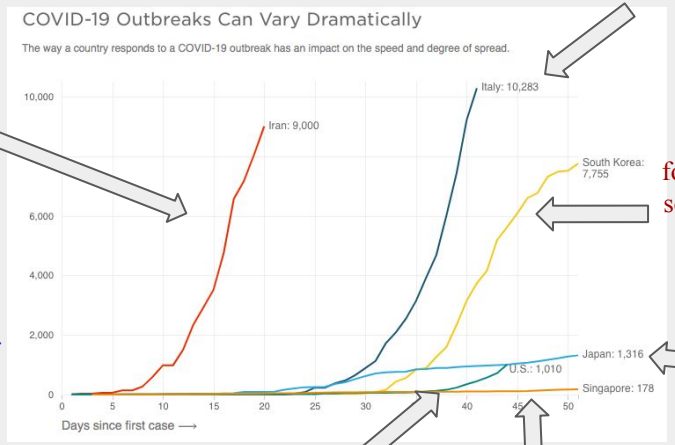


Although complete quarantine for the duration of COVID-19’s incubation period would be the most effective in stopping its spread, most countries are incapable of implementing such a widespread shutdown. Instead, “social distancing” can slow down the rate at which individuals infect large groups of people and can minimize the stress put on the healthcare systems

Comparing COVID-19 Responses

Italy: slow response, limited social distancing and testing early on

Iran: slow response, limited social distancing, lack of transparency



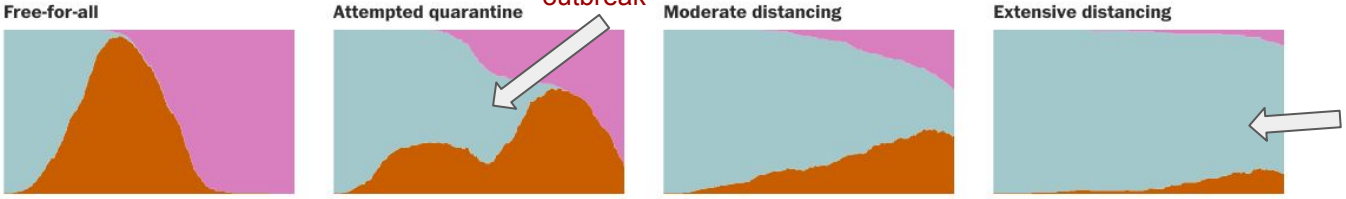
South Korea: quick spread followed by strict social distancing, testing, and transparency

Note: China is not included in this graph, but the high rates of infection seen there have been slowing due to extreme quarantine practices

Japan: early social distancing and testing

US: slow response (depending on state), limited testing

Singapore: organized early response, free healthcare for COVID patients



Risk of second outbreak

Fewer cases, but less immunity (could be problematic if it comes back next year)

Libby

Viruses which cause influenza or colds generally subside as temperatures increase.

Since warmer air holds more moisture, the airborne viruses cannot travel as far thanks to the heavy moisture they accumulate.

Summer seems to elevates people's melatonin and vitamin D, which can invigorate their immune

In colder months, there is increased human contact from spending time indoors.

Sunlight, which is more abundant in the warmer months, is also effective at breaking down nucleic acids of viruses and essentially 'sterilizes' surfaces.

There is evidence that cold air can help protect the virus from degradation in the air and aid its ability to travel through the air.

SO WILL COVID-19 DO THE SAME?

By: Isabel

Flu season typically extends from October to April or March. There is uncertainty over whether Coronavirus will follow the flu's seasonality. Many scientists are looking at the SARS virus, which shares 90 percent of coronavirus' DNA, outbreak. The SARS epidemic started in November and lasted until July, but it is unclear if changing weather or treatment and prevention methods are responsible for the containment. Researchers in Chinese cities found that high temperature and humidity substantially reduced the transmission of the virus, but that alone won't automatically reduce the number of cases. At this point, scientists don't want to lull people into a false sense of security.

HYGIENE PRACTICES DURING THE CORONAVIRUS OUTBREAK*

We're constantly touching surfaces that are contaminated with pathogens, potentially including coronavirus. These pathogens can get transferred to our hands, and then to anything we touch. The coronavirus that causes COVID-19 can live on surfaces for several hours or even days.

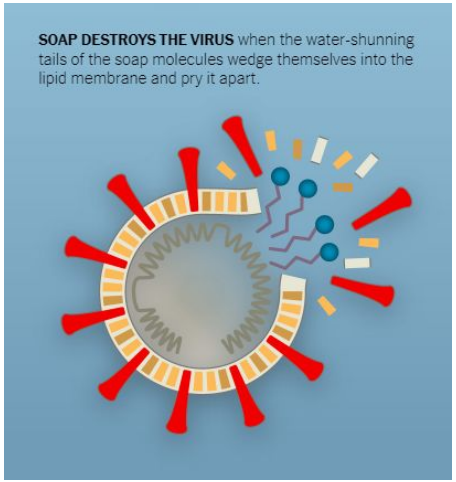
1 Don't touch your face!

The pathogens on your hands can easily be transferred to your face. These pathogens can then enter your body through mucous membranes in your mouth, nose, and eyes. These all act as pathways to your throat and lungs.

2 Wash your hands!

Make sure to lather for 20 seconds and then rinse.

Soap disrupts the chemical bonds that allow viruses to stick to surfaces. The friction of rubbing your hands together helps to lift the microbes and oils off your hands. Soap molecules can also destroy lipid-enveloped viruses like coronavirus by wedging themselves inside the outer shell and prying it apart. Rinsing rids your hands of the full and destroyed pathogens.



you should be doing these always to prevent disease, but especially now!

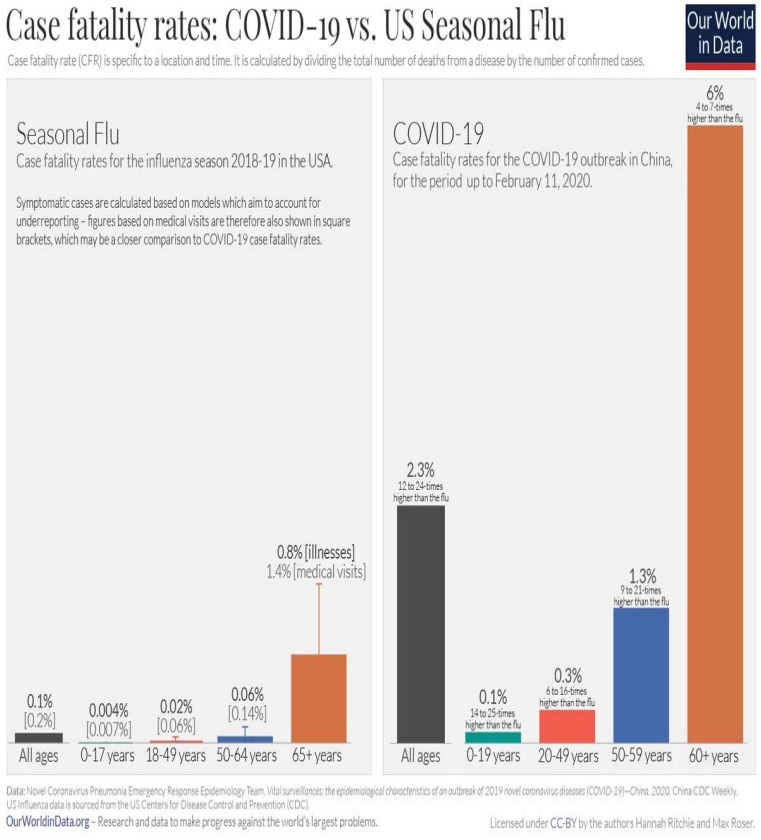
Anna

COVID-19

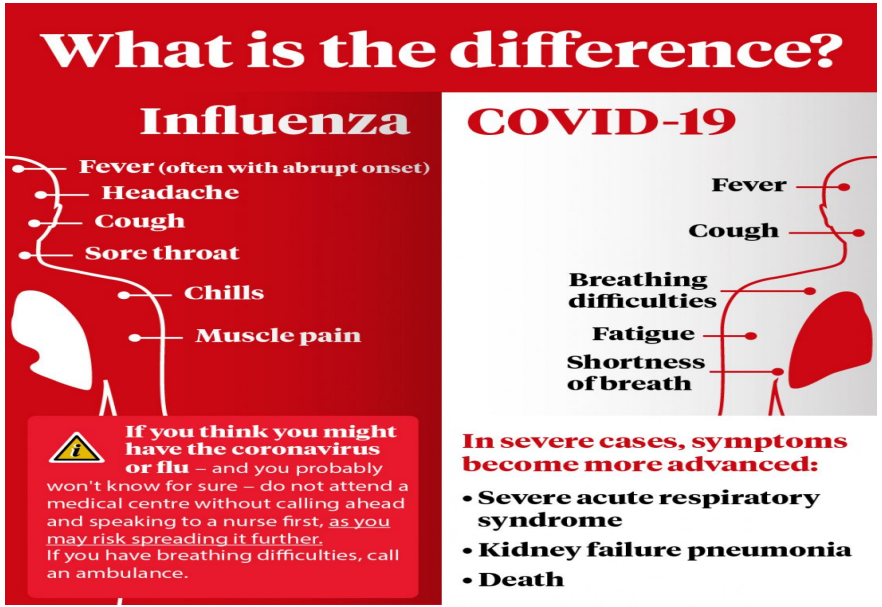
By Youngjoo, Fred, Amaya, Pablo and Morgan

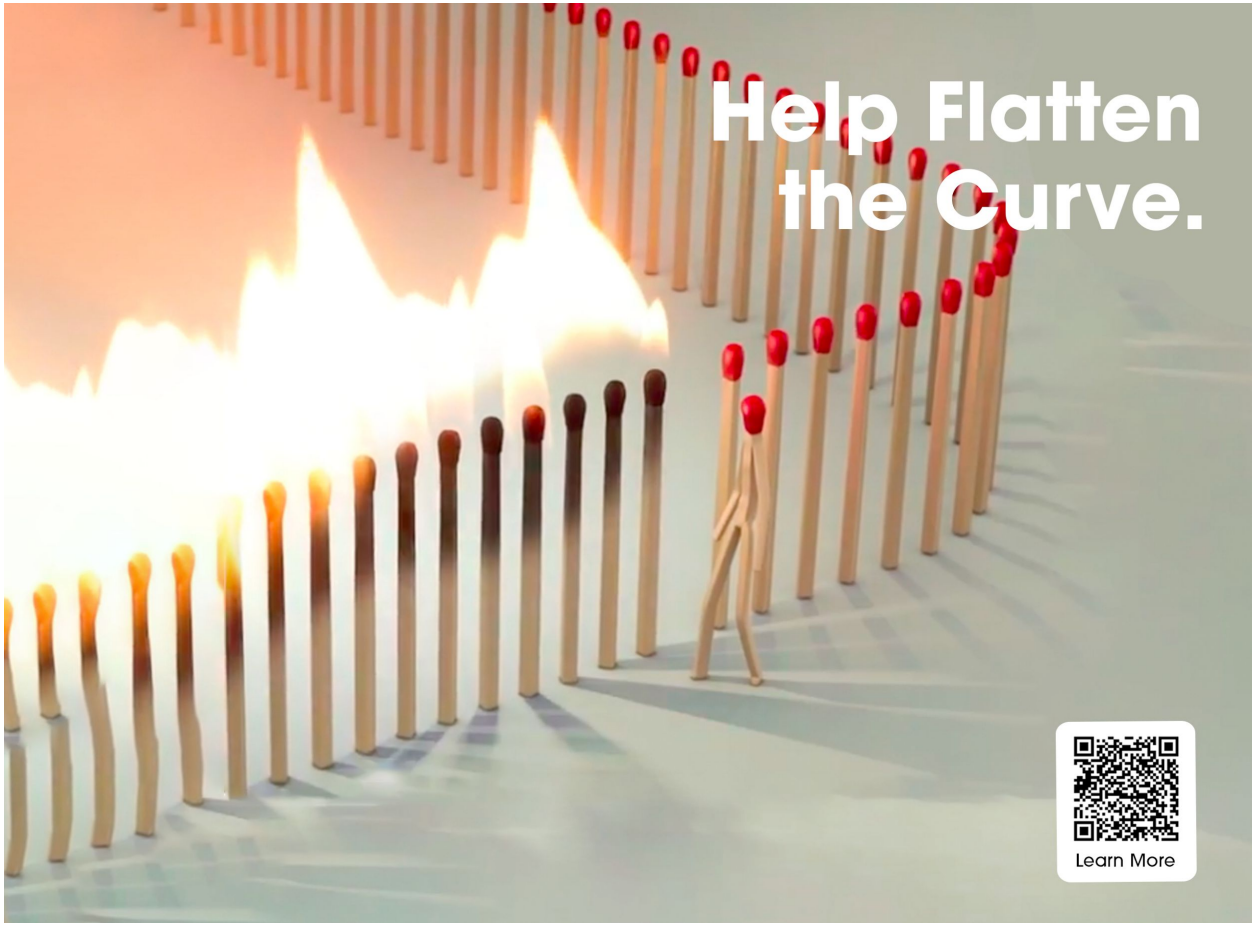
COVID-19 vs. US Seasonal Flu

Youngjoo



- Although there are many similarities between Influenza "The Flu" and COVID-19, they are caused by 2 **different** viruses.
- There are currently vaccines which can address symptoms of or reduce severity of flu, but as of now there are none for COVID-19..




Help Flatten
the Curve.
Learn More

Fred

Wash with soap

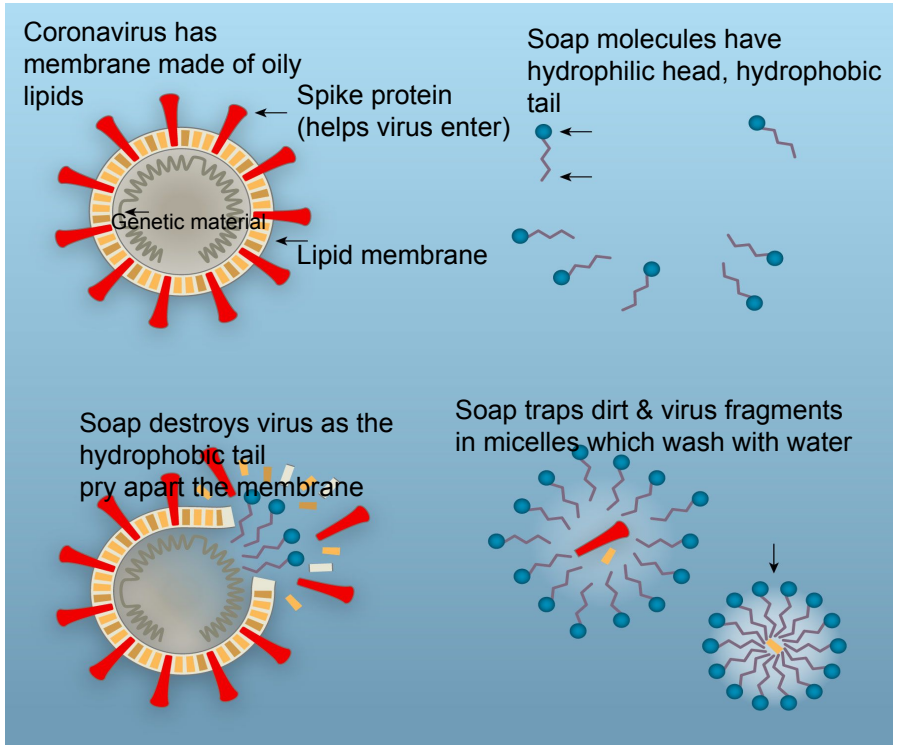


Image from:
https://www.nytimes.com/2020/03/13/health/soap-coronavirus-handwashing-germs.html

Don't touch your face

-We constantly touch surfaces that are contaminated with pathogens and when we touch our face, these pathogens get into the body through mucous membranes (eyes, nose mouth) which enables a pathway to our lungs and throat.

-The coronavirus that causes Covid-19 is believed to be spread mostly by inhaling droplets released when an infected individual coughs or sneezes. But these droplets can also land on surfaces that we touch with our hands.

"Some pathogens can last for about nine days on surfaces, so we are constantly coming in contact with potential pathogens that can cause an infection," said Jennifer Hanrahan, chief of the division of infectious diseases at the University of Toledo Medical Center.

Misconceptions About Mutations

Morgan

When most people think of mutations, they think of sudden drastic changes that could make a virus far more deadly or easily spread. Many science fiction movies and books have explored this concept, but their depictions of mutations are not scientifically accurate--COVID is extremely unlikely to become more deadly due to a mutation

The Coronavirus is an RNA virus, so it mutates frequently because it does not have a system to proofread the copying of its genetic code

However, the likelihood of mutations making a significant change to the deadliness of the virus is extremely low

The traits that could make it more deadly are controlled by multiple genes, and influenced by many evolutionary factors, and each mutation only changes one or two nucleotides

Mutations are very unlikely to affect the number of deaths caused by Coronavirus, and they are actually helpful because they allow us to track the course of the epidemic

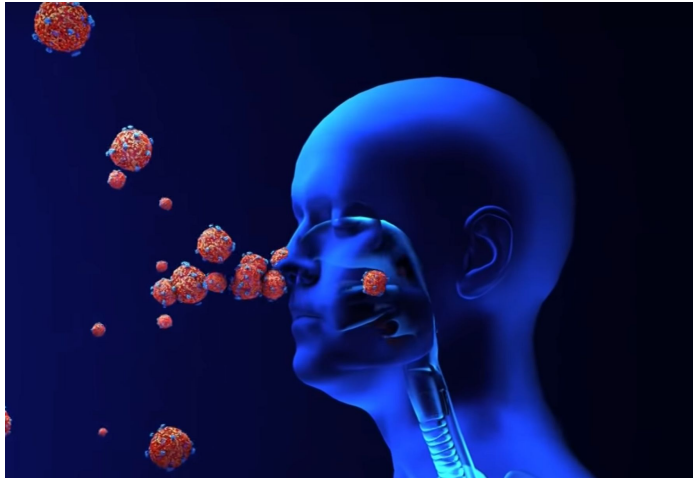
Pablo

Should we wear masks?

- Covid-19 enters the body through mucous membranes (i.e. nose, eyes, mouth) and is transmitted from person to person generally through physical contact with one of these orifices or the direct inhalation of droplets from someone sneezing/coughing.

- Although it is unclear whether the virus is truly airborne, research has shown that it does not linger in the air at high enough levels to endanger most people, not physically near an infected person.

- This means the only people who truly need to be wearing face masks are healthcare workers and already infected individuals and it is far more protective to wash hands and avoid contact with your face



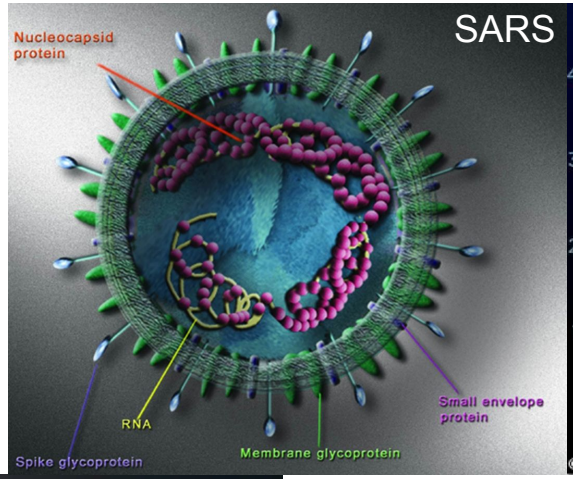
COVID-19

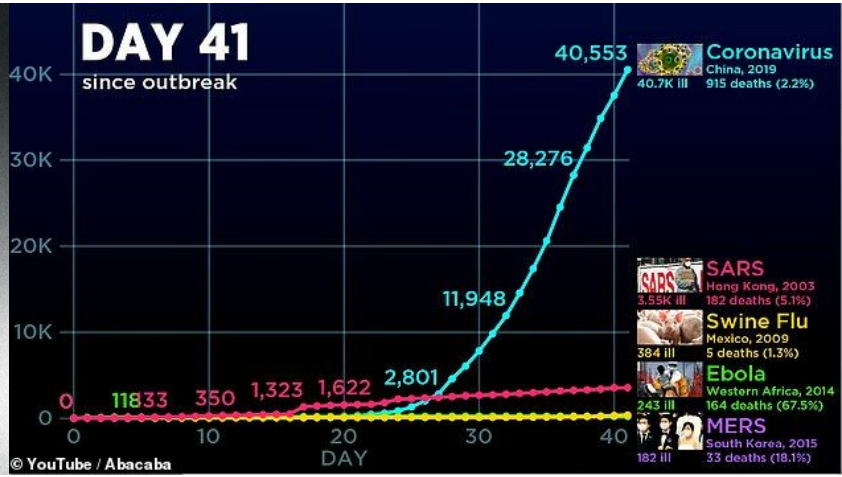
Benjamin

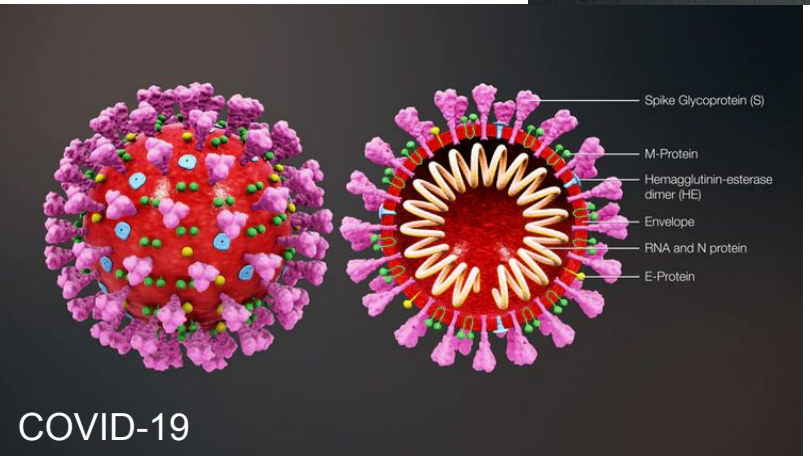
COVID-19 in Comparison to SARS

Similarities:

- Both viruses fall under the classification of a coronavirus and share similar traits except for the make-up of their RNA genomes
- Both viruses infect the respiratory tract and can be spread through any action that ejects mucus such as coughing, which makes them highly contagious





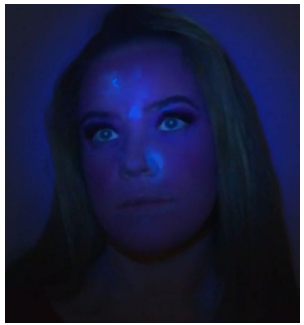


Differences:

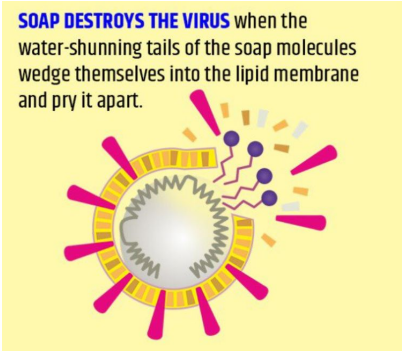
- SARS, though it was highly contagious, showed symptoms quickly after infection, and as a result contract tracing (where people in close contact with infected members are closely monitored) was very reliable and helped immensely with containing the disease. Contact tracing has been ineffective with coronavirus as it has a much longer incubation period, and people in close contact may not show symptoms until up to two weeks later.
- SARS holds a much higher mortality rate of around 5-7% as opposed to the current estimated CFR (Case Fatality Rate) of around 2.3%. For COVID-19, however, many countries may have drastically higher rates depending on the age groups most affected as well as the accessibility of health care.

WASH YOUR HANDS! DON'T TOUCH YOUR FACE! (PSA brought to you by Kelly W.)

Why do you touch your face so much in the first place?
You have lots of nerve endings in your face and hands, so you have heightened sensations in those areas. If your nerves register any discomfort, you will instinctively reach up towards your face.

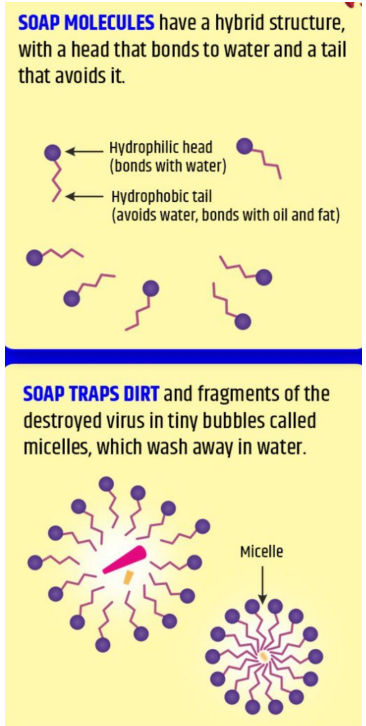


What's the issue with touching your face?
Black light experiment with lotion shows how germs can easily be picked up and lodged in the crevices of your hands and then transferred to your face, granting viruses easy access to your respiratory system.



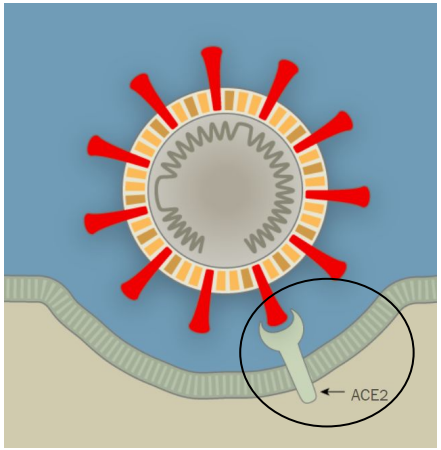
https://twitter.com/drharshvardhan/status/1238889183453646849/photo/1

Why wash your hands with soap?
Soap contains fat-like **amphiphiles** which are structurally similar to the lipids in the virus's membrane. The amphiphiles wedge their way into the membrane (due to similar polarities) and pry it apart. Then the soap molecules carry away the broken down particles as you wash your hands with water since the outer layer of a soap **micelle** is hydrophilic (mixed well with water).



How does Covid-19 infect human cells?

As you guys have probably seen, Covid-19 attaches to ACE2 in order to actually infect a cell.

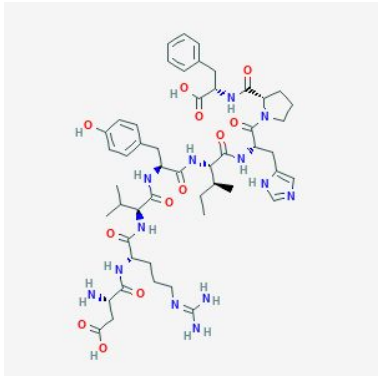


So, you may be wondering:
<u>What is ACE2 and what is its normal function?</u>
It is angiotensin-converting enzyme 2, a protein used in the renin-angiotensin system (RAS), a hormonal system that helps regulate blood pressure. It is most commonly expressed in the lungs, where it's main purpose is to degrade a hormone called angiotensin II, which raises blood pressure.

<u>So what?</u>
A class of drugs used to treat high blood pressure and/or heart failure are called ACE inhibitors. However, there is a difference between ACE and ACE2, and in fact, animal studies have suggested that the usage of ACE inhibitors actually increases the amount of ACE2 present. This has lead some physicians and media outlets to believe that the usage of these inhibitors increases susceptibility to Covid-19.

<u>Is this true?</u>
There is currently no evidence showing that this is actually the case.

The best practice would be to <u>continue taking the drugs you are prescribed and to listen to your doctor!</u>



Angiotensin II

Why Social Distancing is Worth the Cost

Pros

Fewer total infected

Slower rate of infection

Lower burden on hospitals, no overload on healthcare system

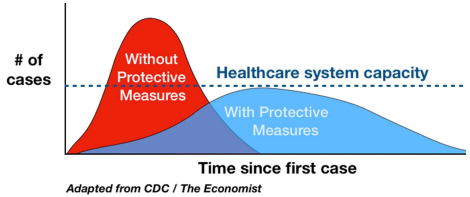
Protects the community and healthcare workers, so they can continue doing their jobs

Cons

Significant impact on economy

Emotional and social toll

Lower productivity, job loss



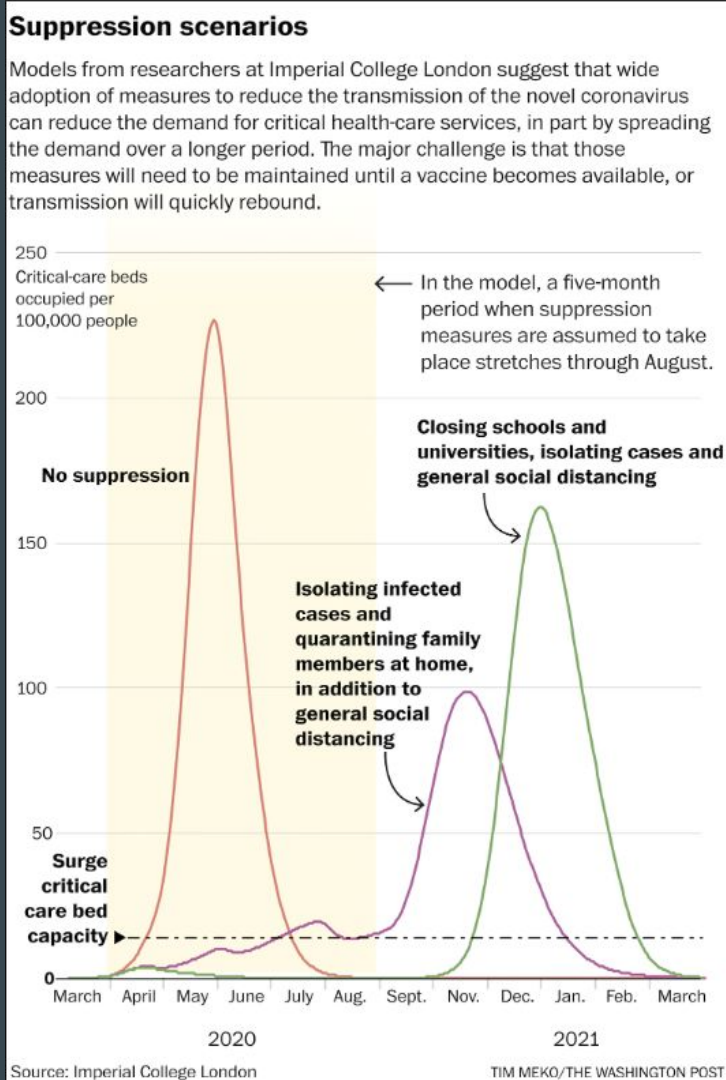
COVID - 19 Presentation

...

Ana, Anya, Mila and William

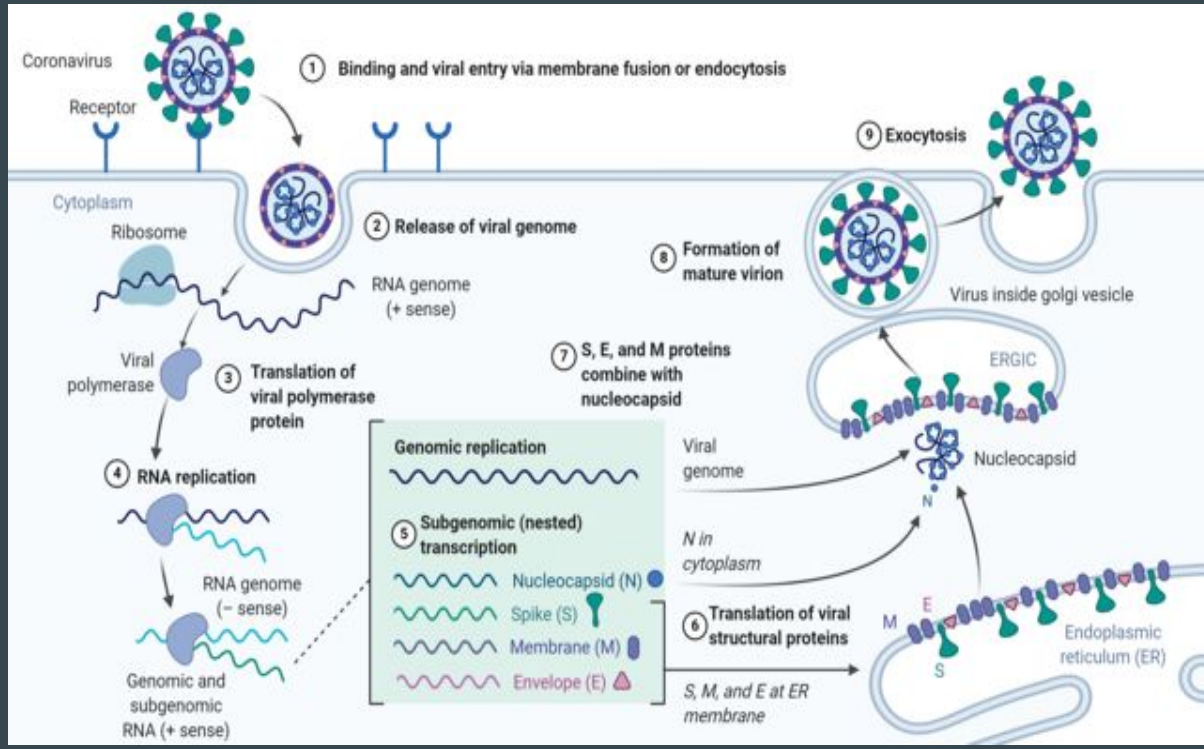
When Will COVID-19 Peak In the U.S.?

- Scientists use the number of secondary transmissions (how many people an infected person infects) as a factor in determining peaks
  - Population dynamics, demographics, health care capacity, etc. are also factors
- If the average number of secondary transmissions goes below 1, the pandemic is past its peak
  - Scientists currently estimate a secondary transmission rate between 2 and 3
- With new influxes of data, models change all the time. To the right are the most up-to-date projections →



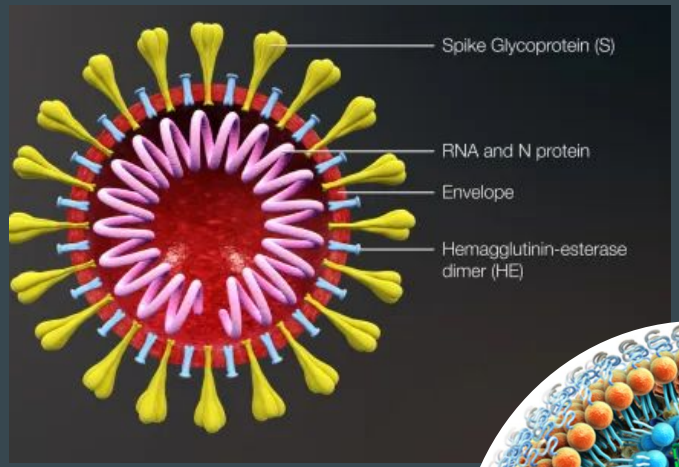
SARS - CoV 2 Life Cycle

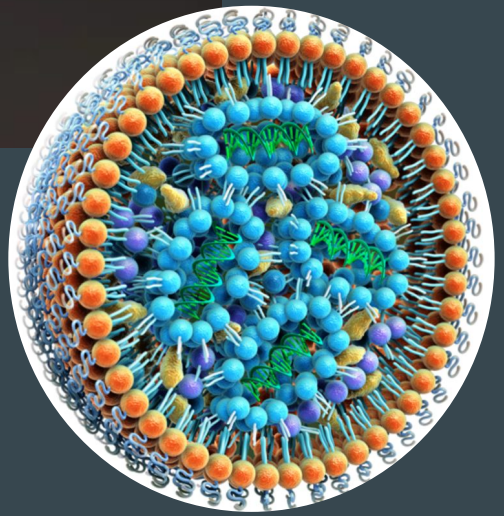
1. Virion binds to the ACE2 protein on the cell's surface.
2. Viral RNA released into cytoplasm.
3. Viral proteins are translated.
4. Viral RNA is replicated by special RNA polymerases.
5-7. Virion reassembled.
8-9. Virus released.



Ana's Slide: Vaccine and possible treatments

- Making a Vaccine
  - prepare the body by providing harmeless viral material for T-cell-derived memory cells to 'remember' the virus
- Current events
  - Chinese authorities sequenced published the SARS Cov-2 genome
  - Clinical trials begun
- mRNA vaccine
  - mRNA-1273
  - Encodes for the protein spikes
  - Lipid nanoparticles
  - Once protein synthesis happens, the immune system recognizes foreign substance and begins to attack the





Coronavirus vs Flu Pandemic of 2009

COVID 19	2% mortality rate	Affects those 60+ yrs	Symptoms evident after 4-14 days	R-nought = 2 - 2.5	Cause: fever, cough, fatigue; some-times vomiting & diarrhea
FLU	0.1% mortality rate	Affected young people	Symptoms evident after 4 days	R-nought = 1.46	