

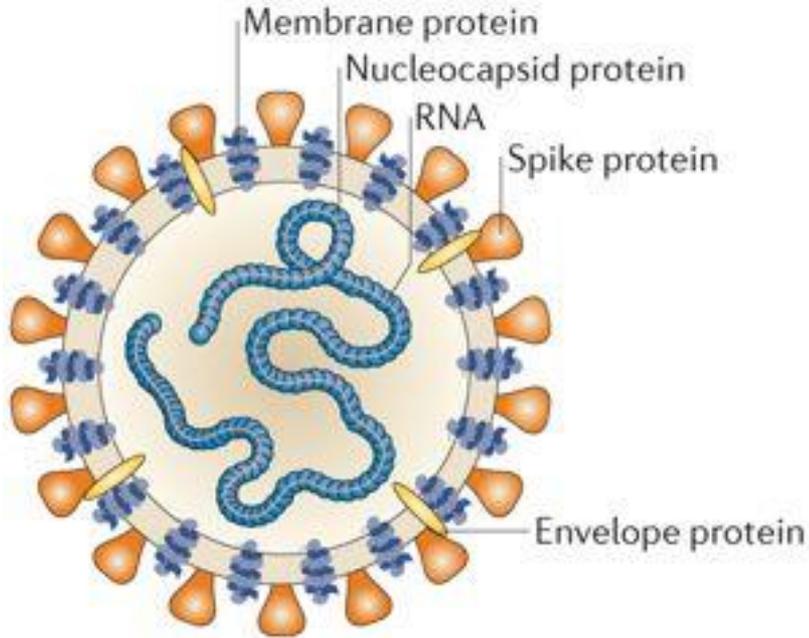


Quick facts about the Novel Coronavirus 2019-nCoV

2020



What is a coronavirus?



Nature Reviews | Microbiology

Source: <https://www.nature.com/articles/nrmicro3143>

Coronaviruses are a type of virus. Remember there are different types of virus, a bit like there are different species of animals and plants.

Possible questions:

1. Are viruses living things?
2. What other diseases can you name that are caused by viruses?
3. In what way is the coronavirus structure similar / different to the HIV / measles virus?
4. How are immune cells able to tell the difference between this virus and the ebola virus?

What is a coronavirus?

- Human coronaviruses are common throughout the world. Seven different coronaviruses, that scientists know of, can infect people and make them sick.
- Human coronaviruses commonly cause **mild to moderate upper respiratory symptoms, in other words a cold**, you've probably caught one at some point in your life.
- Two newer human coronaviruses, **MERS-CoV** and **SARS-CoV**, have been known to **cause severe illness and death**. (<https://www.cdc.gov/coronavirus/index.html>)
- Coronaviruses also infect animals including camels, cats and bats. Sometimes a virus that has evolved to survive and reproduce in other animals can 'jump' species and cause serious disease. (<https://www.livescience.com/new-coronavirus-origin-snakes.html>)

A few facts about the SARS outbreak (severe acute respiratory syndrome):

There have been 2 SARS outbreaks, which resulted in a highly contagious and potentially life-threatening form of pneumonia. Both happened between 2002 and 2004.

Since 2004, there have not been any known cases of SARS reported anywhere in the world.

SARS originated in China in 2002. It's thought that a strain of the coronavirus usually only found in small mammals mutated, enabling it to infect humans.

The SARS infection quickly spread from China to other Asian countries. There were also a small number of cases in several other countries, including 4 in the UK, plus a significant outbreak in Toronto, Canada.

During the period of infection, there were 8,098 reported cases of SARS and 774 deaths. This means the virus killed about 1 in 10 people who were infected. People over the age of 65 were particularly at risk, with over half of those who died from the infection being in this age group.

<https://www.nhs.uk/conditions/sars/>

A few facts about the MERS outbreak (Middle East respiratory syndrome):

MERS is a rare but severe respiratory illness. It can start with a fever and cough, which can develop into pneumonia and breathing difficulties.

MERS was first identified in 2012 in the Middle East and is most common in that region. The risk of infection with MERS to people in the UK is very low.

MERS is spread between animals and people. There's evidence that camels in the Middle East are the main source of the virus.

MERS can also be passed from person to person through cough droplets. But it doesn't seem to be very contagious between people unless they're in close contact.

There have been 5 cases of MERS in the UK since 2012. The most recent case was identified in August 2018, with previous cases diagnosed in 2012-13.

<https://www.nhs.uk/conditions/middle-east-respiratory-syndrome-mers/>

What's the story?

On 31 December 2019, the World Health Organisation (WHO) was informed by the People's Republic of China of cases of **pneumonia** caused by an unknown organism in Wuhan, central China.

On 9 January 2020, WHO announced that a **new coronavirus** had been detected in patient samples in Wuhan. This virus is now referred to as Novel Coronavirus 2019-nCoV.

<https://www.gov.uk/government/collections/wuhan-novel-coronavirus>

Pneumonia is swelling (inflammation) of the tissue in one or both lungs.

At the end of the breathing tubes in your lungs are clusters of tiny air sacs. If you have pneumonia, these tiny sacs become inflamed and fill up with fluid.

<https://www.nhs.uk/conditions/pneumonia/>



Questions

- What is the role of the WHO?
- Suggest how scientists might determine that this was a new type of virus?
- What is the name of the microscopic structures at the end of the air sacs?
- Why is it a problem if these air sacs fill with fluid?
- How do viruses damage cells?

What's the story?

In early January a few new cases were found in nearby countries as a result of infected people travelling. This number rapidly increased over the month.

At the end of the month the outbreak was declared a global health emergency by WHO. The WHO declares a Public Health Emergency of International Concern when there is **"an extraordinary event which is determined... to constitute a public health risk to other states through the international spread of disease"**.

<https://www.bbc.co.uk/news/world-51318246>



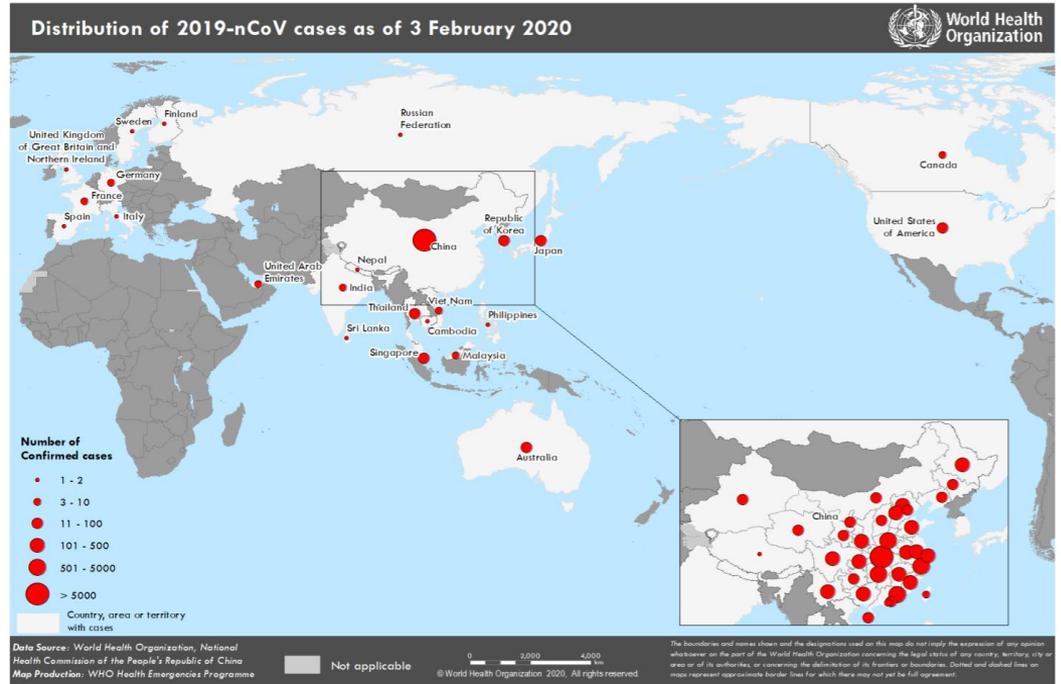
Questions

- Suggest how the impact of the virus in different countries may vary?
- Discuss the disadvantages of a proposal to ban all international travel.

Global spread

As of 3rd February 2020, **17,391 cases and 362 deaths** have been officially reported by the WHO. By far the most of the confirmed cases, **17,238**, are in **China**.

There have been 153 cases outside of China in 23 different countries. Only 1 death outside of China.



https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200203-sitrep-14-ncov.pdf?sfvrsn=f7347413_2

Questions

- What percentage of the people that have been infected with the virus have died?
- Suggest why there might actually be many more cases than the 17,391 stated?

How is the virus spread?



- Coronaviruses are mainly transmitted by **large droplets spread through coughing, sneezing and kissing** and also **contact with infected secretions for example on door handles**.
- In addition to respiratory secretions, other coronaviruses have been detected in blood, faeces and urine.
- 2019-nCoV can pass from **animals to humans as well as human to human**. The animal source is not yet know.
- Most of the people infected are those that **work at live animal markets, family members and health care workers** looking after infected people.
- Unlike SARS, this coronavirus can spread **before a person shows any symptoms** (asymptomatic). This makes controlling exposure and spread much harder.

How is it treated?

There is currently no effective medicine to destroy the virus. Antivirals do exist but are not particularly effective.

Medical staff will provide support to maintain oxygenation of blood and relieve fever and pain.

<https://www.cdc.gov/coronavirus/2019-ncov/about/prevention-treatment.html>



Questions

- Why can't this infection be treated with antibiotics?
- Why is it particularly difficult to attack viruses with medicines?
- What are the stages involved in developing new medicines?

How can countries prevent the spread of this virus?

One of the reasons SARS spread so quickly between countries was because the Chinese government initially played down the severity of the outbreak and international travel quickly allowed the spread of the virus.

China has shut down much of its **transport infrastructure** in the larger cities and residents are being encouraged to stay at home. **International travel** in and out of China is now restricted and some countries are arranging to bring back their citizens from Wuhan and then insisting on isolation on their return.

People in China are encouraged to wear **face masks** and many people are wearing sunglasses or glasses too. All over the world, governments are **educating the public** on how to reduce transmission and to stay alert for symptoms.

<https://www.theguardian.com/science/2020/jan/28/wuhan-evacuation-us-and-japan-to-fly-out-citizens-as-coronavirus-deaths-rise>



Is there a vaccine?

There isn't currently a vaccine for any coronavirus as most cause only mild illness.

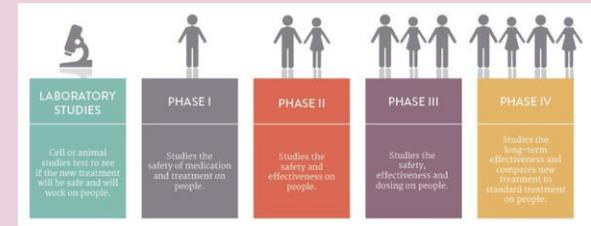
Scientists started work on a vaccine for the SARS virus but the outbreak ended before the work was completed. This vaccine may or may not be useful for preventing illness from the Wuhan coronavirus.

Many research groups and companies are urgently working on a vaccine.

<https://time.com/5768956/wuhan-coronavirus-vaccine-treatment/>

Questions

- What do vaccines contain?
- Describe how vaccinations work.
- Why might a vaccine for SARS not work for Wuhan coronavirus?
- Whose responsibility do you think it is to make a vaccine?
- If a safe and effective vaccine is made, who should get it?



Diagnosis (A level only)

- Diagnosis is critical for **isolating infected patients** in order to reduce the spread of the virus.
- Remember, for many people the symptoms are **cold-like symptoms** so some of the people who think they could be infected will only have a cold and can be sent home.
- Hospitals are being overwhelmed with samples to test so they need a **quick way of getting results** back to doctors and their patients.



Questions

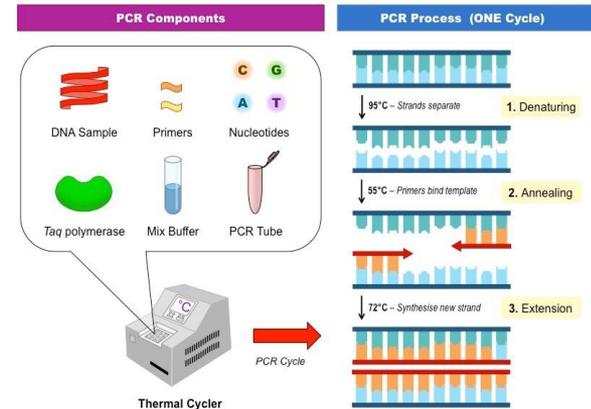
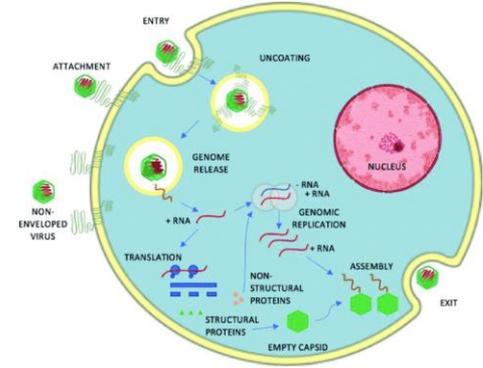
- Why is the method in the photo above ineffective for identifying the virus?
- Suggest how the virus could be identified in a patient?
- Suggest precautions laboratory workers should take when handling specimens.

Diagnosis (A level only)

Infection with 2019-nCoV is confirmed by detection of the **viral genetic material** using **PCR**.

1. Samples from the respiratory system of suspected patients are collected and sent to the lab.
2. In a sample of phlegm there would be **human cells containing replicating virus particles** and therefore the **viral RNA**.
3. **Reverse transcriptase** is used to synthesise the corresponding DNA and specific **primers** are used to **amplify** a specific region **only found** in 2019-nCoV (and also SARS).
4. If PCR yields the amplified copies then these can be further analysed by **sequencing**.

This process takes just over an hour.





Other useful resources:

- WHO Q&A - <https://www.who.int/news-room/q-a-detail/q-a-coronaviruses>
 - WHO video explainer - https://www.youtube.com/watch?v=mOV1aBVYKGA&feature=emb_logo
 - British Government information - <https://www.gov.uk/guidance/wuhan-novel-coronavirus-information-for-the-public>
 - Guardian article “What is coronavirus and how worried should we be?” - <https://www.theguardian.com/world/2020/feb/03/what-is-coronavirus-and-how-worried-should-symptoms-wuhan-china>
 - ASAP Science - “What Actually Happens If You Get Coronavirus?” - <https://www.youtube.com/watch?v=OTYfke545vl>
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