



Science Department
Independent Learning Booklet
Year 7/8

You can use this booklet at home, or at school for your independent learning. It will help you learn more about COVID-19, linking in to some of the topics we study in Science at Whitmore High School.

COVID-19 is the name given to the coronavirus which causes the current pandemic. The extract below is taken from the website [healthychildren.org](https://www.healthychildren.org) which is produced by the American Academy of Pediatrics (accessed 18th March 2020)

2019 Novel Coronavirus (COVID-19)

Human Coronaviruses are a family of viruses that usually cause illnesses like the common cold. Almost everyone gets one of these viruses at some point in their lives. Most of the time the illness only lasts for a short time.



COVID-19: a new coronavirus

It was discovered in December 2019 and has now spread throughout the world. As the virus spreads, we are seeing some people with mild illness, some who get very sick, and some who have died. The reason health officials are concerned is because the virus is new, which makes it hard to predict how it will continue to affect people. Researchers and doctors are learning more about it every day, including exactly how it spreads and who is most at risk.

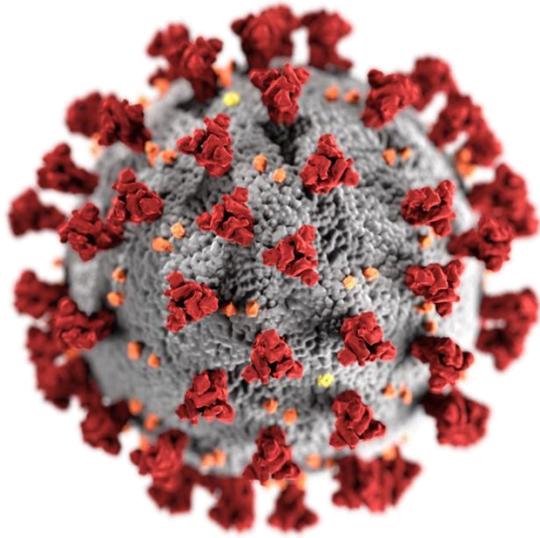
Symptoms of COVID-19

Symptoms of COVID-19 can range from mild to severe and can include:

- Fever
- Cough
- Shortness of breath

Before you start the activities, use the space below to write down everything you already know about coronavirus/COVID-19

Coronaviruses – Basic facts



How it infects our cells:

Coronaviruses are a group of viruses with a characteristic appearance. The name comes from the Latin “corona” meaning crown or wreath. This name was given because of the projections on the surface of the virus particles, which look a bit like the projections on a crown.

Did you know....

Coronaviruses consist of a protein capsule, inside which is a strand of RNA. RNA is similar in structure to DNA and carries the genetic information of the virus.

There are many different coronaviruses infecting lots of different animal species. They usually cause illnesses of the respiratory system. Some forms of the common cold are caused by a coronavirus.

The coronavirus attaches to our cells via the **spike protein**: this is one of the proteins sticking out on its surface. The coronavirus is then taken across the cell membrane to the **cytoplasm**, where the RNA is copied and the information is used to make lots of new virus particles. The new virus particles are then released from the infected cell and breathed out.

Use the information above and your knowledge of cells to label the diagram below, which shows a coronavirus attaching to a cell in the lining of the nose.

Words:

Nucleus

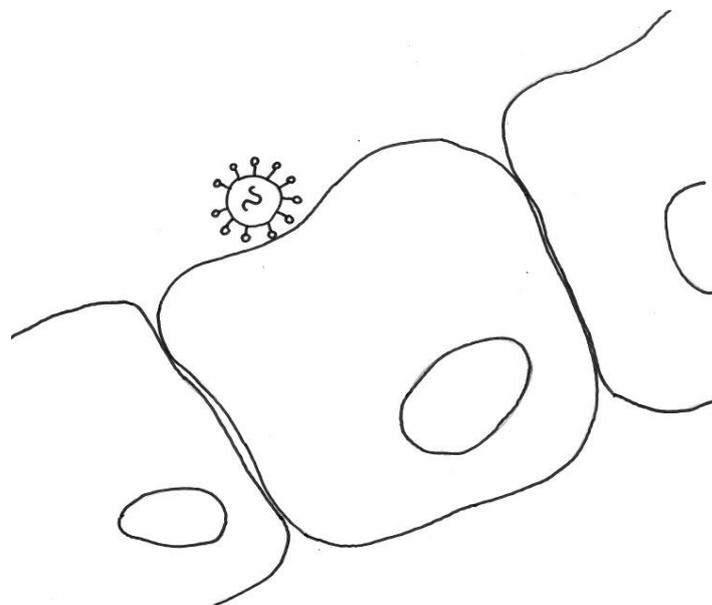
Cytoplasm

Cell membrane

Coronavirus

RNA

Spike protein





Thinking hard: Transform

Make a comic strip in the space below to show how the coronavirus infects cells and is copied.



Spreading of coronavirus

Use a highlighter to show any words which are new to you, or you are unsure what they mean. Look up their meanings in a dictionary, now if you have one, otherwise later on.

Scientists have done many studies investigating how coronaviruses spread between people, and how long the virus can survive outside the body. COVID-19 is too new to be absolutely sure, but so far there is no evidence to suggest it is any different from other coronaviruses. The information below summarises what we know about coronaviruses.

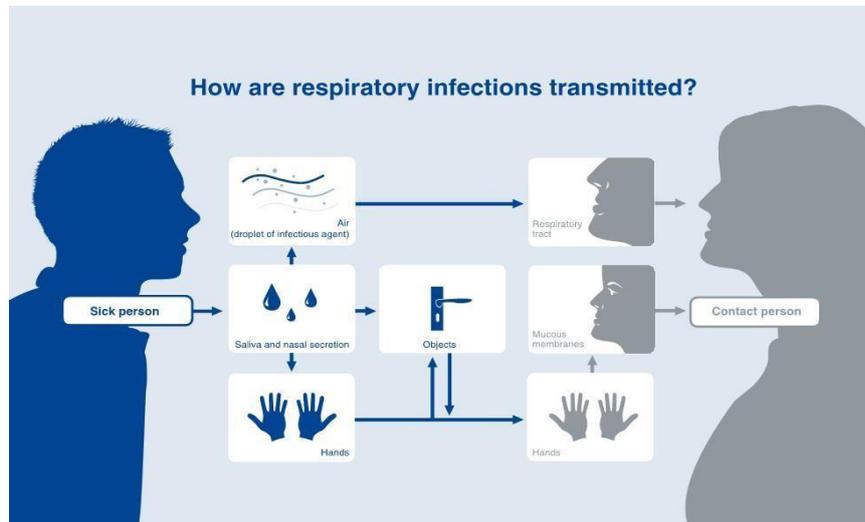


Image from Montavit website <https://www.montavit.com/en> Accessed 18/03/2020

How does coronavirus spread? (information from CDC website: <https://www.cdc.gov/coronavirus/2019-ncov/prepare/transmission.html>)

It is thought that coronavirus is usually passed from one person to another in one of the following ways:

- Through close contact (i.e. spending time within 2 metres of one another, for example sitting next to one another for a meal or to study or play a game)
- By breathing in droplets containing the virus: these are produced when an infected person coughs or sneezes.

It may be possible to catch coronavirus by touching a contaminated surface and then transferring the virus to your face, but we don't currently believe this to be the most common method of spread.

It is probable that people with symptoms of coronavirus are most infectious, and therefore most likely to pass on the infection, but it is also believed that the virus may be passed on by infected people with no symptoms.

How long do coronavirus particles survive outside the body?

Scientists have done experiments to demonstrate that coronavirus remains active and infectious for at least 5 days at room temperature (21°C) on a variety of materials including plastics such as PVC and Teflon, glass and stainless steel. However, metals containing large amounts of copper seem to have an antiviral effect: in some cases inactivating the virus particles in only 40 minutes! (Warness, Little, & Keevil, 2015)

What can you do to minimise the chance of catching (or passing on!) COVID-19? Use the information above to help you write your own protection plan using the template on the next page:

Epidemiology

COVID-19 is a pandemic. This means a large outbreak affecting the whole world.

Epidemiology is the study of disease spread. Scientists called computational biologists can model the spread of diseases using computer software. We are going to use some basic maths and science skills to look at the epidemiology of a new infection, and to model how it might spread.

Scientists use a measure called the R_0 (R-nought) value to show how quickly a disease spreads. For example, the flu virus has a R_0 value of 1.3, which means on average every infected person will pass the virus on to 1.3 other people. The R_0 value for COVID-19 is not yet known, but early studies suggest it is between 2 and 3. For our exercise, we will assume the R_0 value is 2.

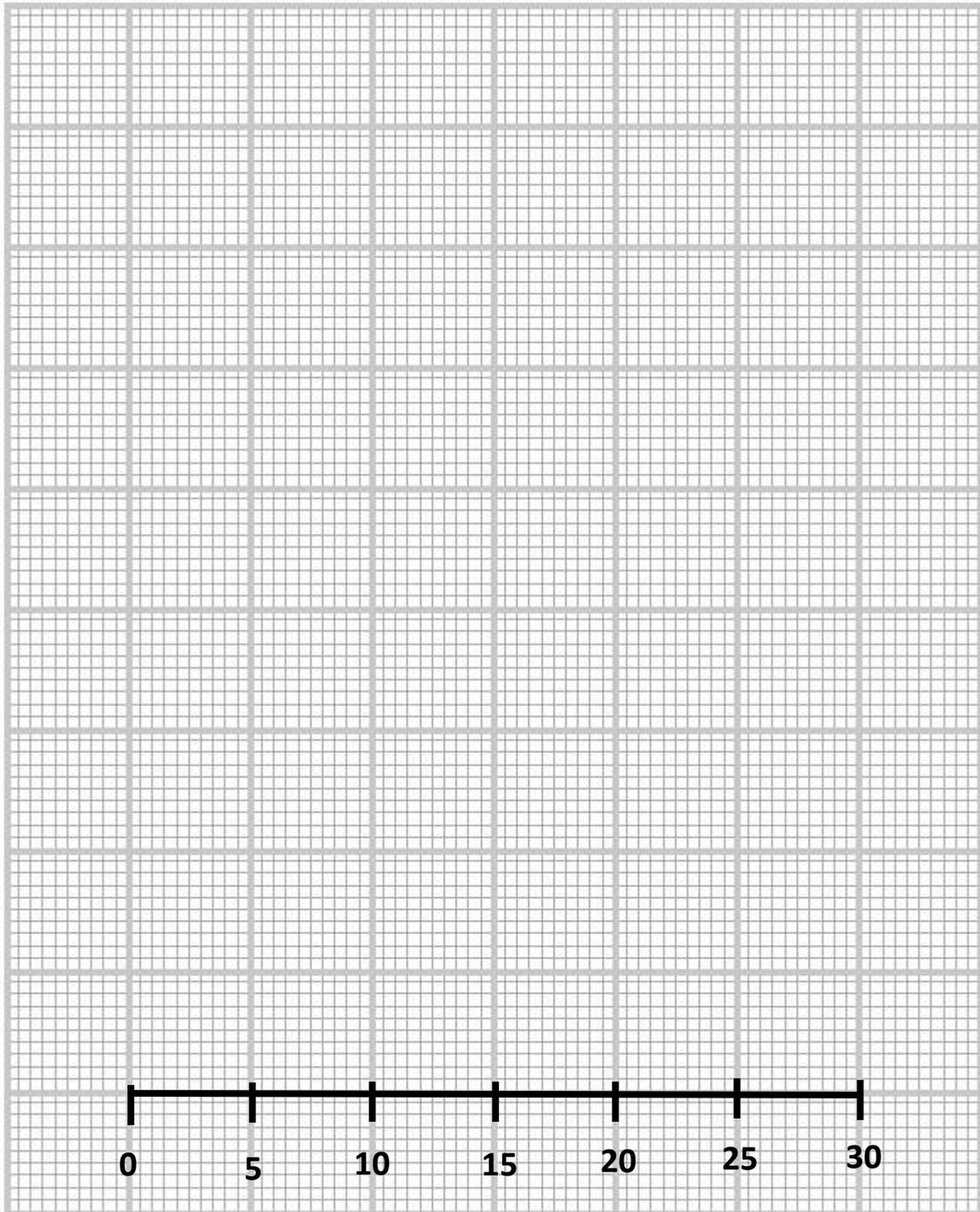
Diseases also have an incubation period: this is the time that passes between the moment the virus enters the body and the when first symptoms appear. The incubation period for COVID-19 has been estimated to be around 5 days (Lauer, Grantz, & Bi, 2020).

Fill in the table below to show how the infection would pass through the student population at LPGS (about 1500 students)

Days after first infection	Number of new cases (each new case will result in 2 more after 5 days, so double the numbers as shown)	Total number of cases (add the number of new cases for this row to the total so far from the previous row as shown)	% of students infected $100 \times \frac{\text{Total number}}{1500}$
0	1	1	
5	2	3	
10	4	7	
15	8		
20			
25			
30			
35			
40			
45			
50			
55			
60			

Extra challenge: Work out how many WEEKS will pass before half of all students have been infected.

On the grid below, draw a line graph to show how the number of NEW cases varies with time for the first 30 days only. You should plot your points carefully and draw a line of best fit. Remember to check your graph for PULSE!



Checking your graph for a PULSE!

Success criteria for a good graph:

Plots – accurate to less than one small square (+/-)

Units – labelled clearly on both axis

Line of best fit (where appropriate)

Scale – graph must cover at least half the paper

Equipment – sharp pencil and ruler to be accurate!

Now mark your graph!

Criteria	Mark
Plots	
Units	
Line	
Scale	
Equipment	
Total	

Vaccines and treatment

Use a highlighter to show any words which are new to you, or you are unsure what they mean. Look up their meanings in a dictionary, now if you have one, otherwise later on.

There has been a good deal of speculation on the news about possible vaccines for COVID-19, but what is a vaccine, how does it protect us, and how quickly can it be made?

Vaccines are used to protect us against diseases caused by bacteria and viruses. They are usually injections. The bacteria or virus is killed or attenuated (changed so that it will no longer cause disease) before being injected. When our body comes across the vaccine, our white blood cells attack it as they would any other germ. Some of these white blood cells remain in our blood, and can recognise the real bacteria or virus if we are infected. The white blood cells will destroy the bacteria or virus before they cause disease. This is called immunity.

It takes many years to develop a vaccine. Once a suitable vaccine has been found, it has to be carefully tested to ensure it is safe and effective. The stages of testing a vaccine (or any new medicine) are summarised in the table below. However, the virus causing COVID-19 is very similar to the coronavirus which caused a previous outbreak of respiratory disease in 2003: SARS-CoV. Scientists have already begun testing a number of possible vaccines for SARS-CoV, and it is believed these will also offer protection against the coronavirus causing COVID-19. This means it is possible we COULD have a vaccine available for use within the next year or so.

Preclinical tests	Animal tests	Phase 1 clinical trial	Phase 2 clinical trial	Phase 3 clinical trial
Human cells in the laboratory	Animals	A few healthy volunteers	A small number of ill people	A large number of people, randomised trial
To study the effects of the drug on cells	To make sure the drug is safe	To make sure it is safe and find out what happens to it in the body	To make sure it is safe and to see whether it seems to be effective	To prove that it is more effective than the best current treatment

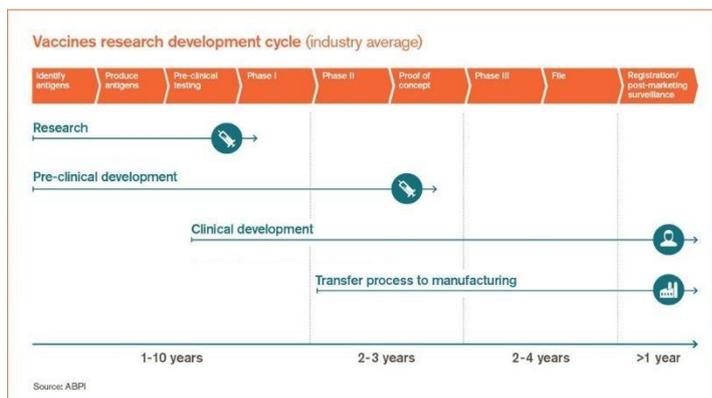
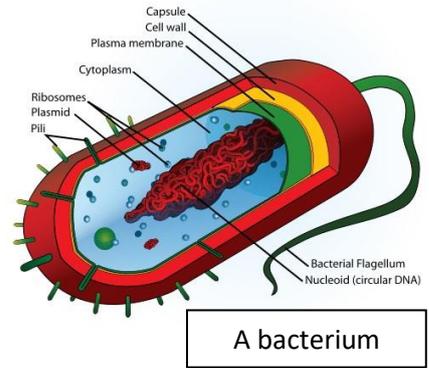


Image: GSK website

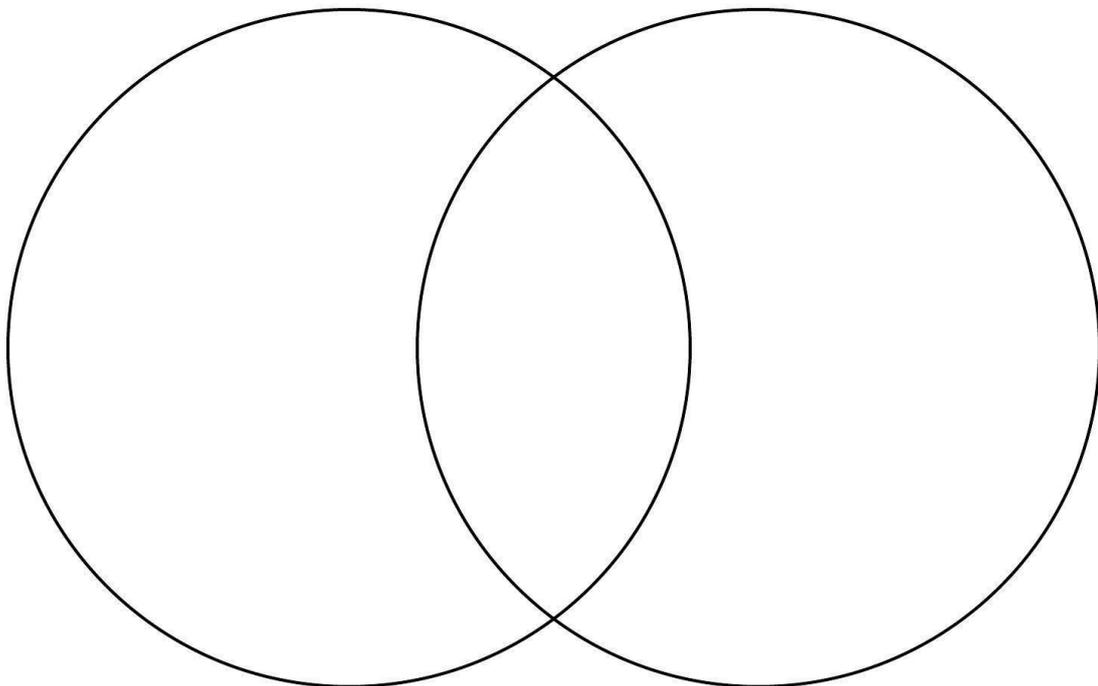
<https://www.gsk.com/en-gb/>

Accessed 18/03/2020

What is the difference between bacteria and viruses? Bacteria are living organisms. Each bacterium is a single cell. They contain DNA, cytoplasm and a cell membrane just like animal and plant cells, but they do not have a nucleus. They have a cell wall and may have other structures such as flagella, which are like little tails. They can reproduce asexually by cell division. Viruses are not made of cells, but instead consist just of a protein casing, inside which they have either DNA or RNA. They have none of the other structures found in the cell, and can only reproduce by invading other living cells. Because of their differences, only bacteria can be killed antibiotics, the medicines we use to cure some infections.



Fill in the Venn diagram to compare bacteria and viruses using the information above.



Summary questions:

1. What does a computational biologist do? _____

2. Give the name of another disease caused by a coronavirus

3. How long do coronavirus particles remain active on most surfaces? _____

4. Give three symptoms of COVID-19

i. _____ ii.

iii. _____

5. What is the meaning of the Latin word “corona”

6. What is the name of the measure used to show how quickly a disease spreads? _____

7. What is a pandemic?

Make a poster or leaflet to show how you think the world will change after the COVID-19 Pandemic.