

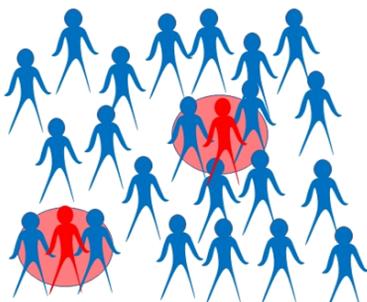
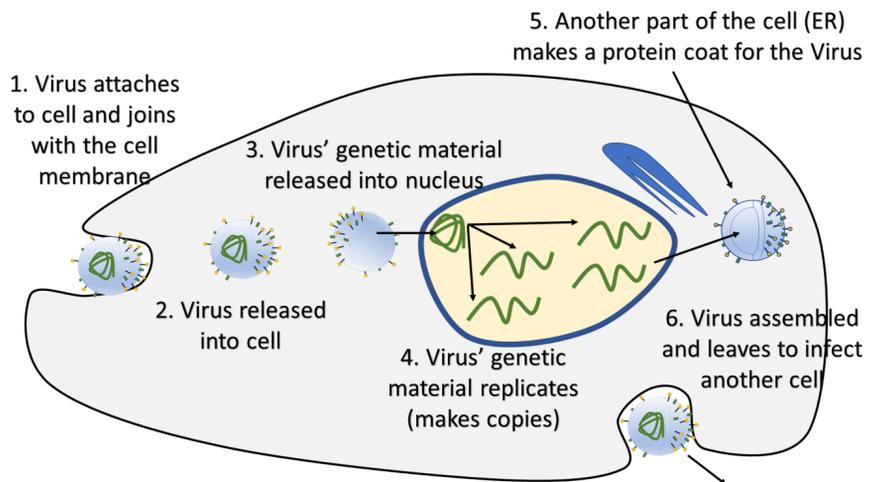
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# Infection and Response Booklet

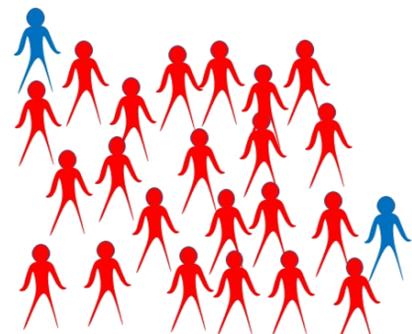
**Infection** is a disease that has affected part of a living thing.

**Response** is what the living thing does in order to stop the infection.

This booklet looks at how our body is affected by diseases, how it fights back and what can be done to stop them with sections on COVID 19. This can be printed out and completed at home with project style activities on each page.



No-one is immunized



Disease spreads through the population

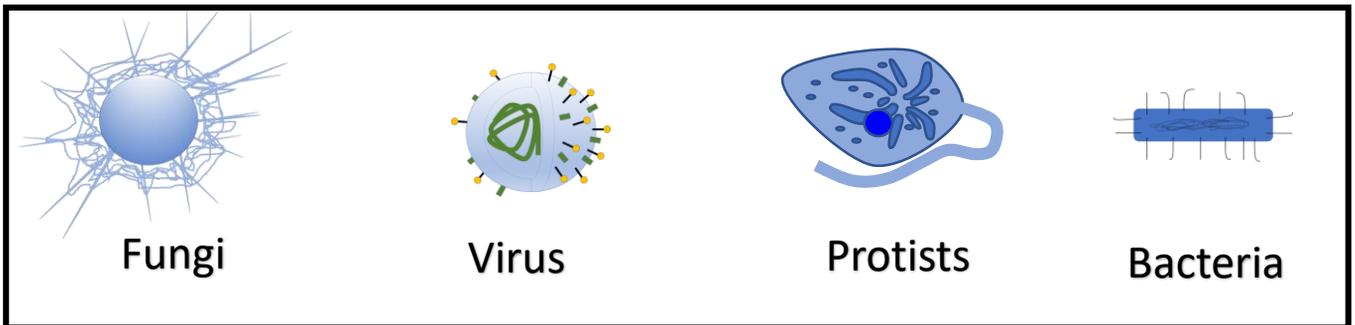
**Communicable Diseases-** Diseases that can be passed (transmitted) between living things.

**Disease-** Something that negatively affects a living thing.

**Pathogen-** A microorganism (virus, bacteria, protist or fungus) that can cause disease.

## A. What are *communicable* diseases?

These micro-organisms can cause diseases that are communicable in living things (e.g. plants and animals) being transmitted between living things.



**Pathogens** are microorganisms that cause infectious disease.

**Pathogens** may be viruses, bacteria, protists or fungi. They may infect plants or animals and can be spread by direct contact, by water or air.

**What things can we do to limit the spread of a disease?**

Bacteria and viruses may reproduce rapidly inside the body. Bacteria may produce poisons (toxins) that damage tissues and make us feel ill. Viruses live and reproduce inside cells, causing cell damage.

**Which of the following are produced by bacteria, virus or fungi?**

Cold	Flu	Athletes Foot	Food poisoning
Sore Throat		Gum disease	Salmonella

**Extension:** Viruses are said not to be living. Which part of MRSNGREN (Movement, Respiration, Sensitivity, Growth, Reproduction, Excretion and nutrition) can they not do on their own?

**Project Activity:** Choose a microorganism and produce an information poster on it (where it is found, how many types, useful or causes illness, cellular structure, how does it transmitted etc.)



**Virus/Viral-** A microorganism smaller than a bacteria that uses a living cell to grow and reproduce and keep itself alive.

**HIV-** Human Immunodeficiency Virus is a virus that attacks the immune system in humans.

**AIDS-** Acquired Immunodeficiency Syndrome is the disease that is caused by the HIV virus.

## B. How are Viruses Spread?



Measles is a **viral** disease showing symptoms of fever and a red skin rash. Measles is a serious illness that can be fatal if complications arise. For this reason most young children are vaccinated against measles.

***A person who has this disease coughs. How does that spread the virus?***

HIV initially causes a flu-like illness. Unless successfully controlled with antiretroviral drugs the **virus** attacks the body's immune cells. Late stage HIV infection, or AIDS, occurs when the body's immune system becomes so badly damaged it can no longer deal with other infections or cancers.

***It is transferred through blood. What precautions do people who have HIV have to take to limit its spread?***



Tobacco mosaic **virus** (TMV) is a widespread plant pathogen affecting many species of plants including tomatoes. It gives a distinctive 'mosaic' pattern of discolouration on the leaves which affects the growth of the plant due to lack of photosynthesis. ***Why does the discolouration affect the rate of photosynthesis?***

**Extension:** HIV is more susceptible of transmission when drug users share needles or people have unprotected sex. Explain why this is.

**Project Activity:** HIV attacks the immune system, produce a diagram that shows how HIV attacks the immune system and how the drugs stop this.



**Food poisoning-** A disease caused by the growth of bacteria on food.

**Resistant strain-** The ability of some types of microorganisms to resist (stop) ways of treating it (e.g. some resistant strains of bacteria are not affected by some antibiotics)

## C. What diseases do Bacteria cause?



*Salmonella food poisoning* is spread by bacteria ingested in food, or on food prepared in unhygienic conditions. In the UK, poultry are vaccinated against *Salmonella* to control the spread. Fever, abdominal cramps, vomiting and diarrhoea are caused by the bacteria and the toxins they secrete.

***What precautions can people take who handle and cook the food?***

Gonorrhoea is a sexually transmitted disease (STD) with symptoms of a thick yellow or green discharge from the vagina or penis and pain on urinating.

It is caused by a bacterium and was easily treated with the antibiotic penicillin until many resistant strains appeared. Gonorrhoea is spread by sexual contact.

***How can individuals stop the spread of sexual diseases like Gonorrhoea? Explain why.***

**Extension:** Why do some ***resistant strains*** of bacteria become hard to treat?

**Project Activity:** Produce a leaflet that is given to people to let people know why some bacteria are becoming immune to antibiotics and what they can do to help.



**Fungi/Fungal-** A large group of organisms that include yeast, mould and mildew.

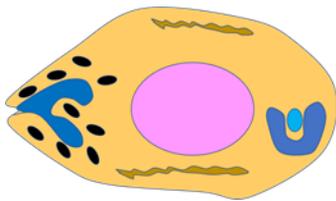
**Protists-** A very varied group of microorganisms that are different to bacteria because they have a nucleus, an example is amoeba.

## D. What are other common diseases?

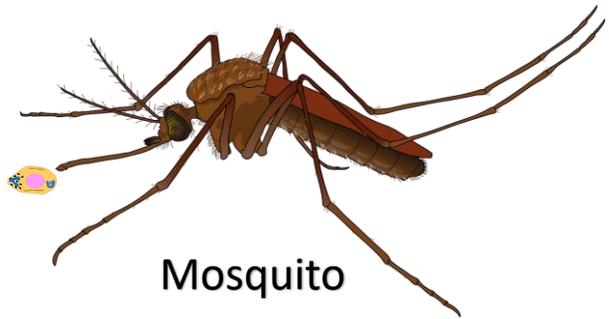


Rose black spot is a **fungal** disease where purple or black spots develop on leaves, which often turn yellow and drop early. It affects the growth of the plant as photosynthesis is reduced. Suggest ways in which the fungus can transmit from plant to plant.

***Rose black spot can be treated by using fungicides (which kill the fungus). Suggest other ways in which the disease can be stopped.***



Protist



Mosquito

The pathogens that cause malaria are **protists**. The malarial **protist** has a life cycle that includes the mosquito. Malaria causes recurrent episodes of fever and can be fatal.

**Extension:** *What can people in malaria affected countries do to stop acquiring malaria?*



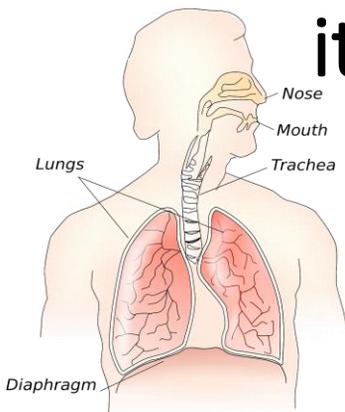
**Project Activity:** What other methods are being used to stop Malaria. Research some ideas and produce a leaflet/poster with what you have discovered.

**Antimicrobial-** A substance that kills microorganisms.

**Platelets-** Live in the blood and produce fibrin when exposed to air that then forms a mesh over a wound to stop the flow of blood.

**Mucus-** A thick sticky liquid for trapping particles such as pathogens.

## E. How does our body protect itself from disease?



The body uses these parts of our body stop / trap / kill pathogens:

- skin
- nose
- trachea and bronchi
- stomach

*Skin* is a thick layer of cells around your body. It secretes (produces) **antimicrobial** liquid. When the *skin* is damaged **platelets** in the blood start the clotting process forming a scab. The *nose* contains **mucus**, a sticky liquid. When we sneeze this liquid comes out of our body. The *trachea* and *bronchi* (for breathing) produce **mucus**. When we cough this liquid comes out of our body. The *stomach* is pH 2, a strong acid. Using the information to explain how different part of our body stop, trap or kill the pathogens:

**The skin**.....

**The nose**.....

**The trachea and bronchi** .....

**The stomach**.....

**Extension:** Which is the most effective? Explain why.

**Project Activity:** Watch the news. Is the precautions that countries have taken recently slowed or stopped the transmission of the virus. Write an article for a blog putting your views down.

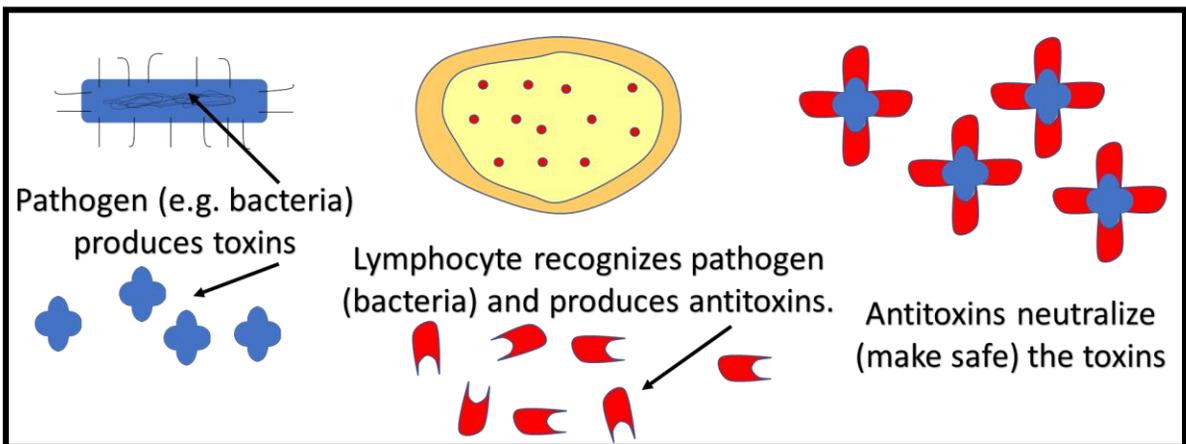
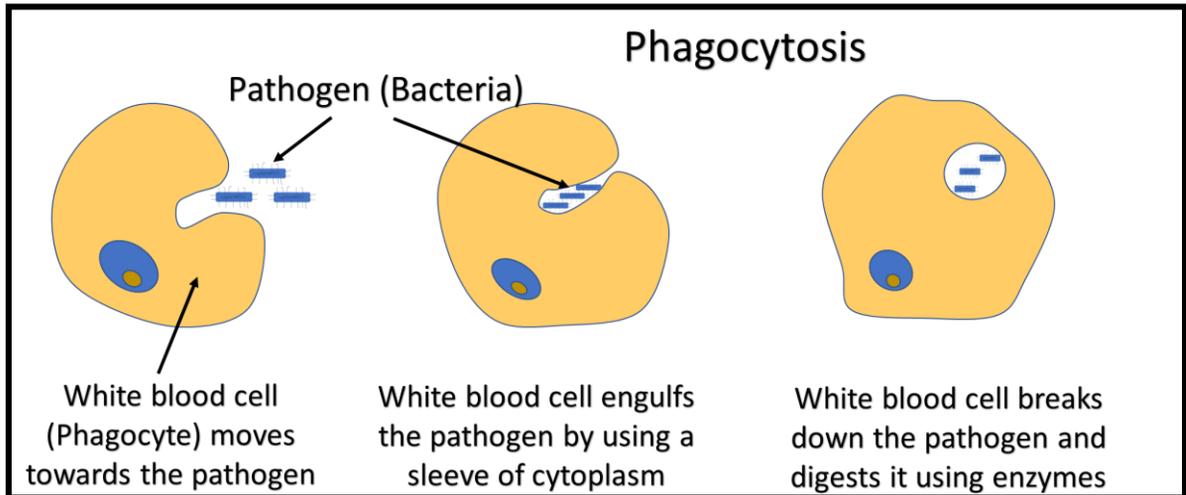


**Phagocytes-** A type of white blood cell that ingests (eats) pathogens.

**Lymphocytes-** A type of white blood cell that produces antigens.

**Antitoxins-** Chemicals with specific shapes that stick to the outside of toxins to make them harmless.

## F. How do white blood cells fight disease?



Using the diagrams, explain the job of the following (in fighting disease):

**The phagocytes.....**

**The enzymes.....**

**The lymphocytes.....**

**The antitoxins.....**

**Extension:** What does the body need to do if a new disease come along?

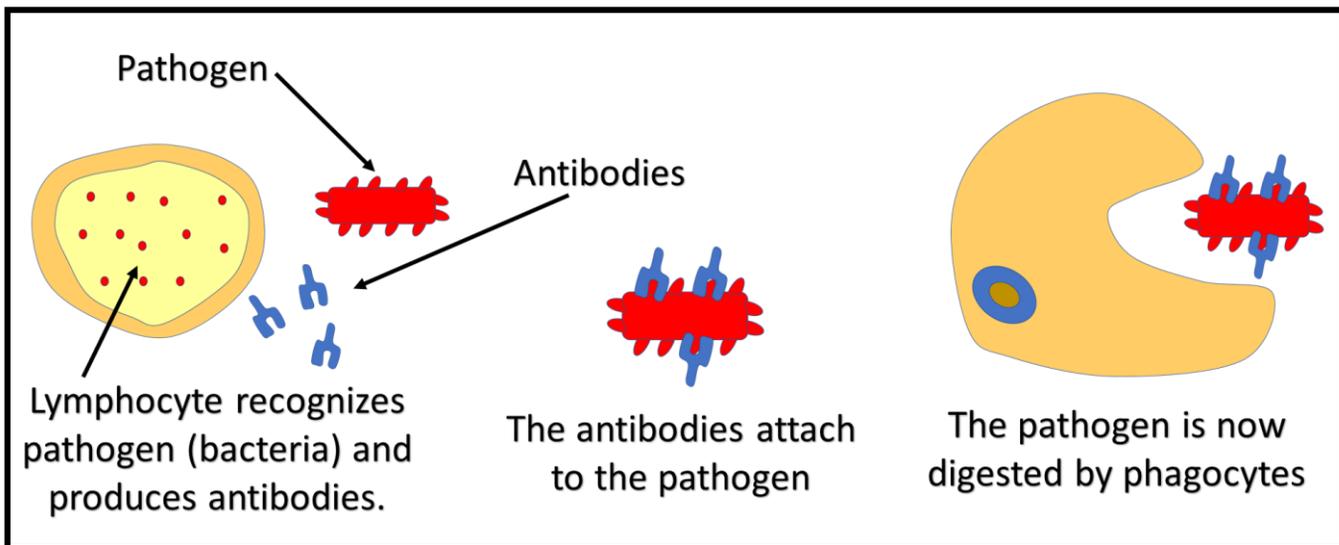
**Project Activity:** There is more to the immune system than what is on this page, watch a youtube such as this <https://www.youtube.com/watch?v=jzFDGz-bjcM> Write down what you have learned from this video.



**Antibodies-** Chemicals with specific shapes that stick to the outside of pathogens for phagocytes (white blood cells) to ingest.

**Vaccination-** Introducing small quantities of a dead or inactive pathogen to stimulate the production of antibodies.

## G. How does *Vaccination* help fight disease?



The body fights pathogens by producing **antibodies** which make the pathogen able to be ingested by a phagocyte (white blood cell).

Using the diagrams, explain the job of the following (in fighting disease):

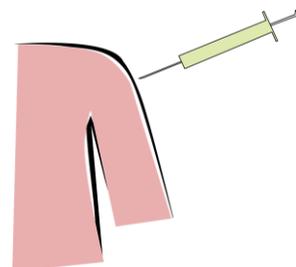
**The phagocytes.....**

**The lymphocytes.....**

**The antibodies.....**

**Vaccination** involves introducing small quantities of dead or inactive forms of a pathogen into the body to stimulate the white blood cells to produce antibodies.

**Explain what will happen if the same pathogen re-enters the body?**



**Extension:** Why do we vaccinate babies?

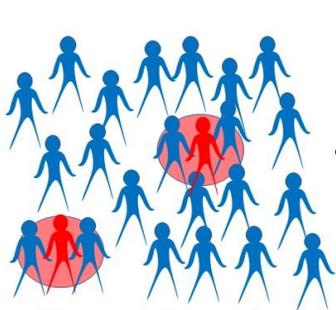
**Project Activity:** Research which diseases don't yet have vaccinations. What are the reasons? Produce an information poster on why.

**Immunity-** This is where a living thing is not affected by a certain pathogen.

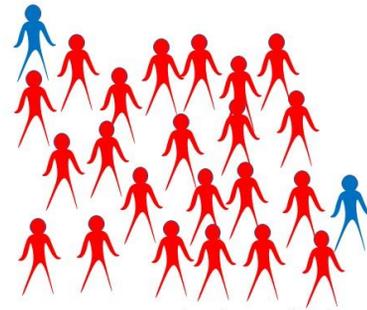
**Herd Immunity-** This is where a group of living things is not affected by a certain pathogen.

## H. How can *herd immunity* help us?

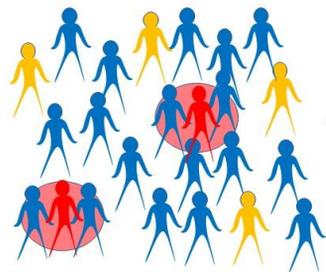
Look at the diagrams below to understand what happens when a large number of people are immune to a disease.



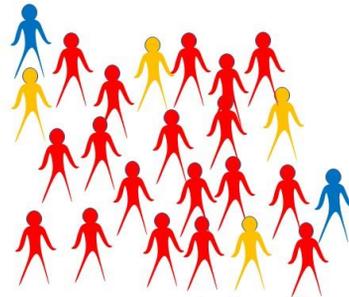
No-one is immunized



Disease spreads through the population



Some people are immunized



Disease spreads through most of the population



Most people are immunized



Disease is contained

*Using the diagrams. Explain why immunising a large number of people will limit the spread of a disease.*

*Why has this group got herd immunity?*

**Extension:** If disease spreads through a population (without vaccination) then people will eventually become immune to it. What problems will we encounter if we do that?

**Project Activity:** Some people did not have the MMR vaccine as a baby and some have develop measles. Storyboard a video for YouTube to explain to people why this happening.



**Antibiotic-** A medicine that can kill *bacteria* in the body.

**Painkiller-** A medicine that lowers the amount of pain in an animal.

## I. What do Antibiotics do?



Penicillin is an antibiotic that kills bacteria and is found on mouldy bread.

**Antibiotics**, such as penicillin, are medicines that help to cure bacterial disease by killing infective bacteria *inside* the body. It is important that specific bacteria should be treated by specific antibiotics. The use of antibiotics has greatly reduced deaths from infectious bacterial diseases. **Antibiotics cannot** kill viral pathogens. **Viruses reproduce inside a cell. What would happen if we used a drug to attack the virus? Why?**

**Painkillers** and other medicines are used to treat the symptoms of disease but do not kill pathogens. **What are the similarities and differences between painkillers and antibiotics?**

**Extension:** What should scientists do if strains of bacteria resistant to antibiotics increase?

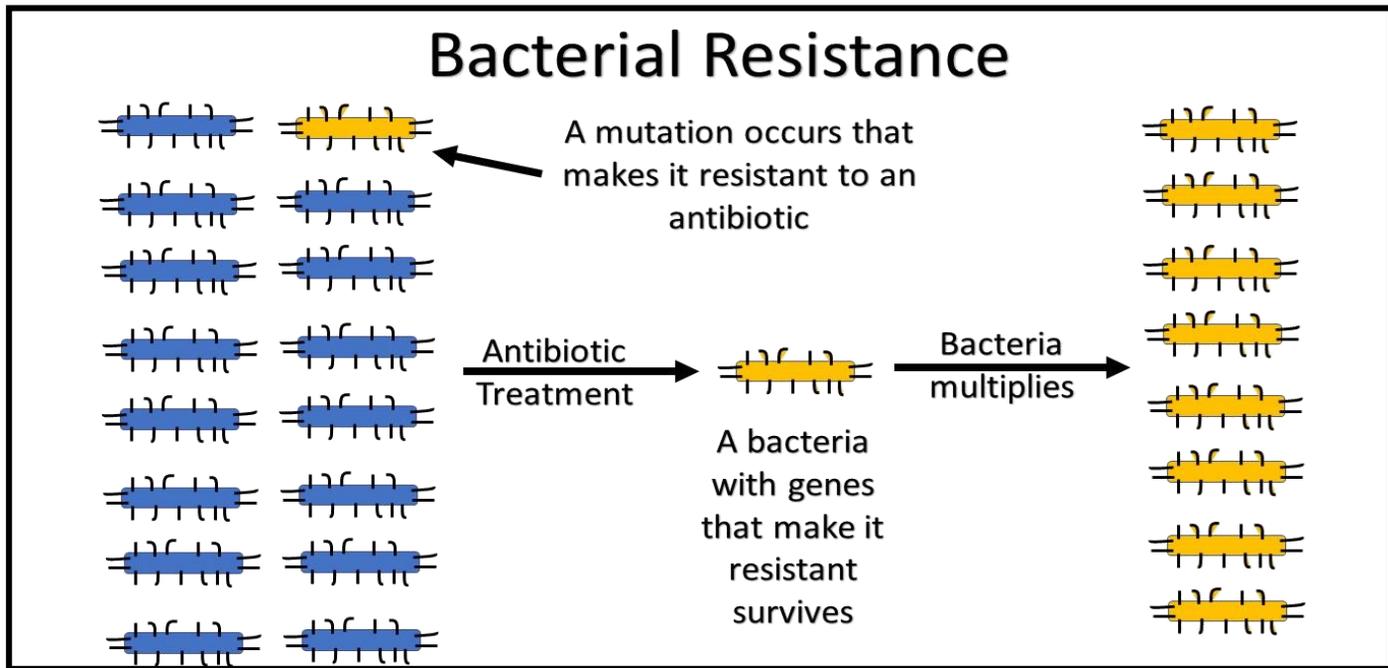
**Project Activity:** Produce a Poster to go into Doctors to explain why antibiotics cannot be given to people with a cold.



**Mutation-** A slight change in a living things DNA that can affect its features.

**Resistance-** The ability to stop something.

## J. Why do some Antibiotics stop working?



Bacterial pathogens (diseases) are treated with **antibiotics**. If a mutation occurs and produces a bacteria that is resistant (not killed by the antibiotic). They survive and reproduce, so the population of the resistant strain of bacteria rises. This new resistant strain of bacteria will have no effective treatment. **MRSA is resistant to antibiotics. How do you think this came about?**

Scientists have recommended these practices; explain how they will help:

**Doctors should not prescribe antibiotics when not needed because.....**

**Patients should complete their course of antibiotics because.....**

**Antibiotics should be restricted in animals because.....**

**Extension:** Why might people want antibiotics that won't work rather than let their body fight the disease itself?

**Project Activity:** Try to find out what doctors can do to treat “super bugs” that are resistant to most antibiotics and produce a leaflet or poster on what you find out.

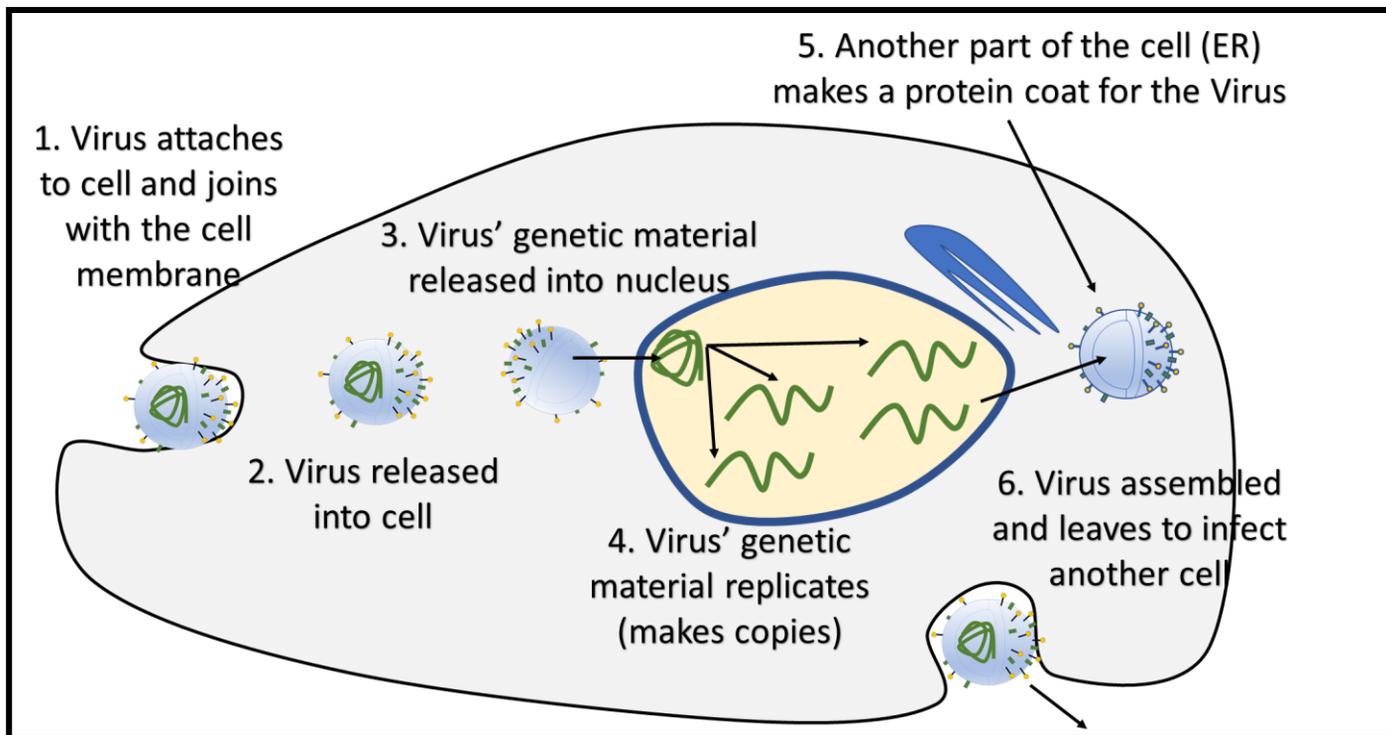


**Virus-** A microorganism smaller than a bacteria that uses a living cell to grow and reproduce and keep itself alive.

**Ciliated Cells-** These are hair like cells that can move mucus.

## K. How do viruses cause illness?

Viruses once in the body, enter a cell, make 1000's of copies of themselves and then invade nearby cells. The diagram below shows how. We feel ill because the cells in our body that are infected cannot do their job properly.



Viruses can be carried by animals and then transferred to humans. In the case of Corona virus (COVID 19), it joins to receptors on **ciliated cells** in and around the lungs. It enters the cells, makes 1000's of copies of itself destroying the cells in the process. The debris from this enters the lungs.

***Why do people who get the corona virus cough?***

***Why is coughing the main way this virus is transmitted?***

**Extension:** What type of facemask would be needed to stop a virus contained in a droplet?

**Project Activity:** Produce a leaflet/poster on the difference between how bacteria and viruses cause illnesses and are treated.

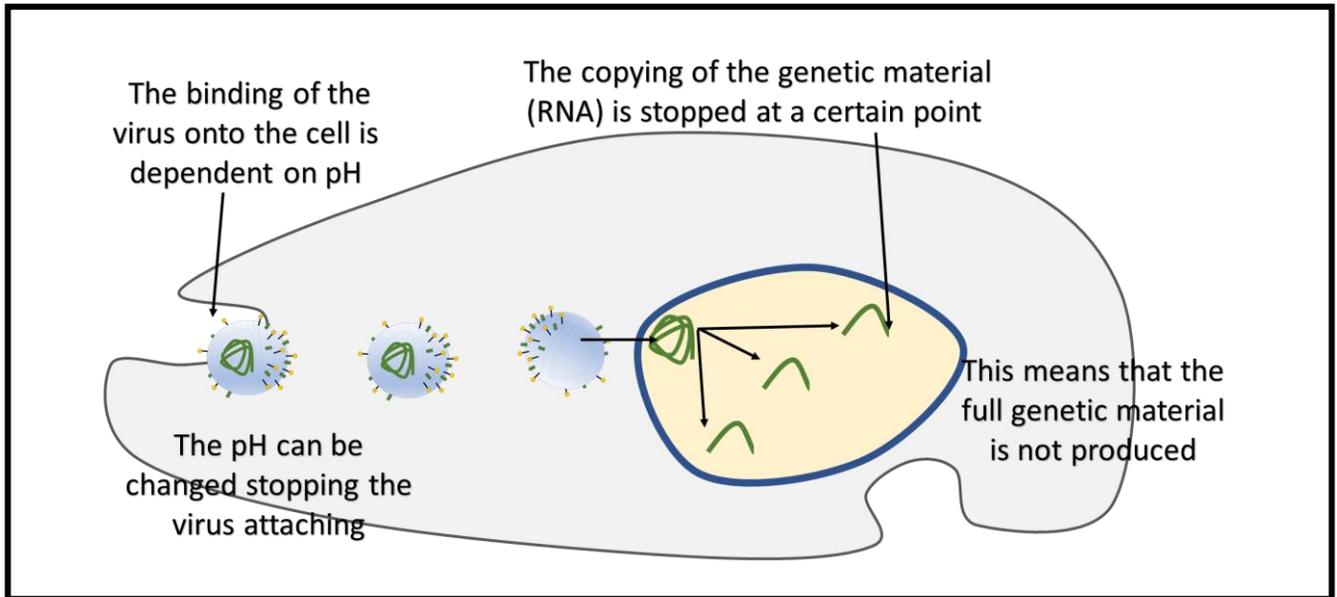


**pH-** A measure of the acidity (pH 1 strong Acid, pH 7 Neutral, pH 14 Strong Alkali)

**RNA-** A polymer similar to DNA, but with only one strand.

## L. How might we stop Viruses?

Viruses can be stopped by stopping the replication of their genetic material (RNA) inside the nucleus or changing the pH on the surface of the cell.



**Which of the two ways would be better to stop the virus? Explain your answer.**

Another way that viruses are stopped is by the bodies natural defence system. The cells that are attacked produce cytokines. These can slow down virus production and activate natural killer cells which have antiviral properties. The Lymphocytes and Phagocytes (as we saw earlier) can also be stimulated to destroy the cells infected by viruses. **Why would someone with a reduced immune system or on immunosuppressant drugs be of particular risk with a virus?**

**Extension:** Why are vaccinations for bacterial diseases easier to produce?

**Project Activity:** Look at the research that is being done on the Corona Virus. Produce some information on the ways they are trying to stop the virus. Chloroquine and Remdesivir are two promising drugs.



# M. What needs doing before we can give people drugs/vaccines?



Traditionally drugs were extracted from plants and microorganisms. The heart drug digitalis originates from foxgloves. The painkiller aspirin originates from willow. Penicillin was discovered by Alexander Fleming from the *Penicillium* mould.



Now, most new drugs are synthesised by chemists in the pharmaceutical industry. However, the starting point may still be a chemical extracted from a plant. New medical drugs have to be tested and trialled before being used to check that they are safe and effective.

***Why do we need to test drugs before we give them to people? (Clue: Toxicity, Effectiveness, Dose)***

In Pre-clinical trials, scientists start in laboratories using the drug on cells, then move up to tissues, then live animals.

***Why not try the drug straight away onto animals?***

Clinical trials are next in which they use healthy volunteers and patients. Very low doses of the drug are given at the start of the clinical trial. If the drug is found to be safe, further clinical trials are carried out to find the optimum dose for the drug. Then double blind trials are started with some patients are given a placebo. ***A placebo is where people are given a tablet that has no effect but are not told. Why do you think this is done?***

**Extension:** Find out what double blind trials are. Why are they important to measure the effectiveness of a drug?

**Project Activity:** Produce a leaflet explaining what needs to be done to produce a cure. Outline how long this might take and why.

