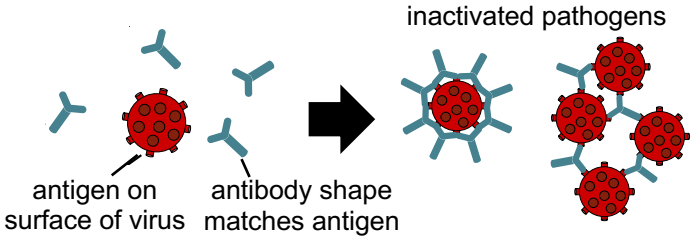
9 Vaccination & COVID-19

Links:
- *Exploring Science* 9Dc
- *Edexcel 9-1* CB5g, SB5j

Immunisation



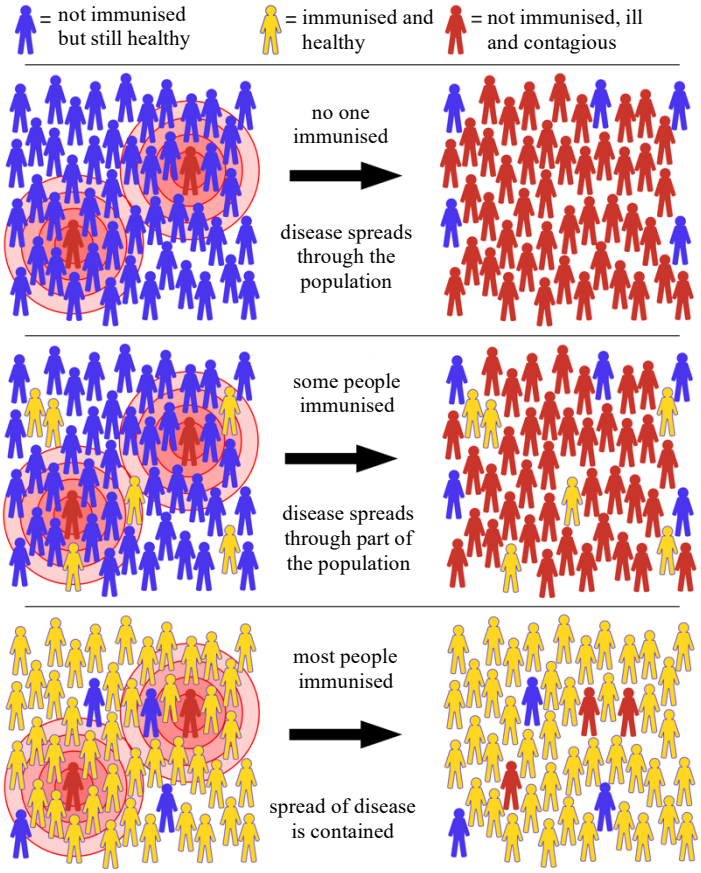
Having a disease can make you **immune** to it because the pathogen causes the body to create **memory lymphocytes**. If the **pathogen** infects you again, these cells quickly become active and produce **antibodies** with a specific shape that fits onto the **antigens** on the pathogen. The antibodies help to inactivate the pathogens.

Vaccines

A **vaccine** is used for **immunisation** - making people immune to a **contagious disease** (one that can be spread). One of the first vaccines was against smallpox. It killed 30% of people who got it.

In the 1790s, Dr Edward Jenner noticed that people who looked after cows often got cowpox (a mild disease) but did not get smallpox. He developed a hypothesis that cowpox protected against smallpox. He tested this in 1796, when he squeezed pus from a cowpox spot into a cut on a boy's arm. The boy caught cowpox. Eight weeks later, Jenner repeated this using smallpox pus. The boy did not get smallpox. Jenner used the Latin for cow (*vacca*) to make up a word for his discovery.

In 1959, the World Health Organisation set out to eradicate smallpox using vaccines. The last person to catch its serious form was a three-year-old Bangladeshi girl in 1975. She was isolated, and health workers visited all homes within 5 miles to vaccinate people and search for other cases. Smallpox no longer exits.



Today, we inject many different types of vaccine. An 'attenuated vaccine' is a very weak form of the pathogen that does not cause disease. A few people with very weak immune systems cannot have these vaccines. However, if most people around them are immunised they are still protected. This is **herd immunity** (see the graphic on the right).

Over 80 groups of scientists are now searching for an effective COVID-19 vaccine. Many are developing 'subunit vaccines', which only contain the pathogen antigen molecules.

Find out

I. 1. a. Find out the name of the smallpox virus. _____

b. Who was the last person to get the milder form of smallpox? _____

c. Who was the last person to die from smallpox? _____

d. How did this person get the disease? _____

2. Find out the name of a vaccine used today that is:

a. attenuated _____ b. subunit _____

c. killed (the pathogen has been treated so that it is totally inactive) _____

3. Do some research to link each scientist with what they discovered and when.

Scientist	What they discovered	When
Edward Jenner	Having a disease gives you immunity.	1796
Louis Pasteur	Cowpox prevents smallpox.	1955
Peter Panum	One of first to invent a COVID-19 vaccine.	1846
Jonas Salk	Developed successful killed polio vaccine.	2020
Kizzmekia Corbett	Developed first subunit vaccine.	1981
Maurice Hilleman	Weakened viruses can cause immunity.	1880

Test yourself

4. Explain how immunisation can help people who are unable to have a vaccine.

_____

_____

5. The hepatitis B vaccine is a subunit vaccine. Explain how this can make people immune.

_____

_____

_____

_____

_____

Check-up

I. Check your answers.

II. Doctors often use models to help explain things to patients. Use plastic modelling bricks (e.g. LEGO®) to model how antibody shapes fit antigens.

Answers

Note to home educators

The worksheet is designed to support understanding of immunity and immunisation. You may wish to share these objectives with students:

- Explain the role of the immune system in defence against disease (including pathogen antigens, lymphocytes, antibodies and memory lymphocytes). (GCSE)
- Explain the body's response to immunisation using an inactive form of a pathogen (GCSE)
- Discuss the advantages and disadvantages of immunisation, including the concept of herd immunity (GCSE Biology)

To access this sheet, students will need a knowledge of pathogens, molecules and the immune system. It may be helpful for students to use Worksheet 8 before this one.

It is suggested that students complete the worksheet independently, using the internet for questions 1 - 3. Questions 4 & 5 should be completed without help from additional sources.

Some questions will be accessible by students in Year 9 but most of this sheet is drawn from GCSE 9-1 Science specifications (Combined Science and Single Science Biology).

If you wish to check the answers, keep this part of the sheet away from the questions!

I. 1. a. *Variola* (There are two forms *Variola major* and *Variola minor*, the latter of which causes the milder form of the disease.)

b. Ali Maow Maalin (in Somalia in October 1977) c. Janet Parker (in September 1978)

d. She is thought to have caught it via a ventilation system that carried the virus from a research lab at the University of Birmingham into her photography studio.

2. There are many possible answers to this question. Common examples include:

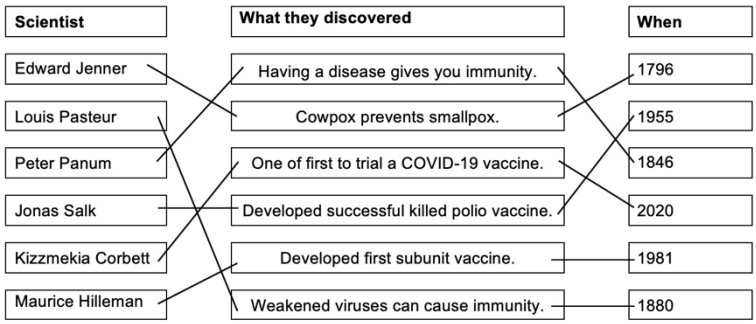
a. (attenuated) rotavirus, MMR, some flu vaccines, shingles, chickenpox, TB (BCG)

b. (subunit) pertussis (whooping cough), hepatitis B, HPV, some flu vaccines

c. (killed) polio, hepatitis A, some flu vaccines, rabies, Japanese encephalitis

(Note that there are other types of vaccine.)

3.



4. If most people are immunised, then the few unimmunised people have a very low chance of coming into contact with an infected person. Herd immunity protects them.

5. Aim for five or more of the following points in a logical order: The subunit is the antigen (from the pathogen). The body makes antibodies to attach to this subunit. Memory lymphocytes are formed. These cells can make these antibodies quickly. If the real pathogen enters the body, the memory lymphocytes are activated. Antibodies are quickly produced. They inactivate the pathogen.

II. Models should show the Y-shape of an antibody and a snug fit to the antigen.