Workshop title: Going Viral (KS3)
Document: Home teaching Guide

1. Overview

In this 45-minute workshop, students will develop their understanding of how the body responds to harmful pathogens, and how this relates to immunity. Students will explore how vaccines mimic this process to take advantage of the natural functions of the immune system and will create models demonstrating the concept of herd immunity through vaccination.

2. Learning objectives

Students will be able to describe key processes in the body for fighting viruses, using scientific vocabulary. They will be able to explain how the body develops immunity to viral infections through exposure, and how vaccines mimic this process. Students will develop their understanding of herd immunity and the role of vaccination in wider public health.

3. Curriculum links (KS2) - *Working Scientifically*

- Ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience
- Make predictions using scientific knowledge and understanding
- Apply mathematical concepts and calculate results

4. Kit list

- PowerPoint
- Home teaching Guide
- Print/draw grid
- Playing counters (40 x blue, 40 x green, 40 x red)
- Stopwatch or use your phone

5. Step by step instructions

INTRODUCTION – 15 minutes

SLIDE 1

- What is a virus? (**Take suggestions**)
- What is immunity? (**Take suggestions** - if students are struggling, ask if they have heard of the 'immune system')

SLIDE 2

For each word on the slide ask the students if they know what it means. Talk through immunity using the words and pictures on the slide. **Ask the student to repeat and/or write down any vocab they were not already familiar with.**

- The **immune system** is the name for all the different things in our bodies that work together to help protect us against illnesses caused by tiny micro-organisms called **pathogens.**
- Our bodies defences range from our skin - creating a physical barrier that stops harmful pathogens from entering our body, through to our **white blood cells**, which we will explore today.
- These **pathogens**, like viruses or bacteria, are so small we need powerful microscopes to see them. When a pathogen enters our body, our immune system works to fight it in lots of different ways, stopping us from getting ill or helping us to get better.
- While bacteria and viruses can both cause mild to serious infections, they are different from each other. Our immune system responds to them in different ways, and we use different types of medicine to prevent and treat illnesses caused by them. Today we are only going to be investigating **viruses**.
- The parts of a virus that make us sick are called **antigens**. Antigens trigger an immune response in the body.
- One of the key ways that our immune system fights the virus is by making something called **antibodies.**
- Antibodies are proteins made by our **white blood cells**, and they attack the virus. When a new virus enters our body and we get sick, our body has to learn which type of antibody to make to fight it.

- But the immune system is very smart. If the same kind of virus enters our body again our body can normally remember the right antibody to fight it. So we are protected from getting sick.
- This is called **immunity**. When we are immune to an illness it means our body can fight the harmful micro-organisms that cause the illness much more quickly - sometimes before we get any symptoms at all.

Explain that today they are going to do some activities to investigate further how immunity works, and how scientists are using that knowledge to help prevent the spread of diseases.

SLIDE 3
Let's start with an example. **Ask:**

- Does anyone know someone that has had measles?
- Do you know what kind of pathogen measles is caused by? *Measles is a virus.*
- How do you think your immune system fights the measles virus? (*By producing proteins called **antibodies**)*
- *It is extremely rare to have measles twice.* Why do you think it's so rare for someone to get measles twice? ***(Take suggestions -** explain that when someone has measles, their body learns to fight the virus)*
- Explain that if they are exposed to the virus again, their body already knows how to make the right antibody to fight it, so the virus is normally defeated before the person experiences any symptoms - they are **immune** to measles.

SLIDE 4
Each time you have a virus your body has to learn to fight that particular virus. Like in a video game - sometimes you need to use a different weapon or learn a different technique for fighting a different enemy. **Ask:**

- Who has played minecraft?
- Do you kill all the monsters the same way?
- What happens if you attack a skeleton underwater in minecraft? *(It can't sink so it cannot fight back)* What happens if you try the same technique on a spider? *(Nothing, spiders don't drown in minecraft).*
- What would you do if you were attacked by a new monster you had never seen before? (Prompt for - try all the weapons and fighting techniques you know until you learn how to defeat them. Because it takes time to figure that out, your character will probably take more

damage fighting them the first time, but the next time you will be able to defeat them faster).

- Well, immunity works in a similar way - just because your body knows how to make the right antibodies to fight chickenpox, it doesn't mean it knows how to fight other viruses. When you get infected with a new virus, your body must try different antibodies until it finds the right one.

ACTIVITY (Zombie Virus Game) – 25 minutes

SLIDE 5
Ask students:

- What medicine do we use to **prevent** the spread of viruses?
- Have you had any vaccinations?
- How do you think a vaccine works? ***(Take suggestions)***

SLIDE 6
Play the video on slide 8. Explain that when we get a virus and our body learns how to make antibodies to fight it, we call this **immunity**. Scientists have developed vaccines that imitate this process. Vaccines put weak or dead versions or parts of the virus into our bodies so that our immune system can learn which antibodies to make to fight the virus, without us getting sick.

SLIDE 7
Explain that vaccines don't just stop you from getting ill, they also help stop the spread of disease, and have the potential to totally eradicate a virus from existence. One example is smallpox. Smallpox used to be a major infectious disease. In the 20th century about 300 million people died from smallpox. People got a very bad fever and skin rash, and about 3 out of 10 people with the disease died. Because of the smallpox vaccination the disease was eradicated, and the last natural case of smallpox was in 1977.

You do not need to vaccinate a whole population in order to control a future outbreak of a virus, if a certain proportion of the population has been vaccinated, the whole population can be protected. This is known as **herd immunity. Ask:**

- If there was a new virus at school, what percentage of students do you think we would need to vaccinate to stop people from getting ill from

the virus? ***(Take suggestions*** *- explain that there is not one answer, it depends on many factors, such as how easily the virus is transmitted****)***

SLIDE 8
Explain that now they are going to investigate herd immunity through a zombie virus game.

Play in pairs or individually

Give pair/individual a grid handout, a bag of counters (3 different colours), and a stopwatch.

Ask them to fill every space on the grid with blue counters.

SLIDE 9
This is an unvaccinated population. The zombie in the top left can infect people to the right and below. It can infect one person every 3 seconds. Explain that our grids are a different size to the one on the slide.

Round 1: Ask students to put a green counter in the top left to represent the zombie virus. They should use the stopwatch to see how quickly the virus spreads through the whole population (swapping the blue counter with a green one when it is infected). Remind the students again that the virus can infect one person every 3 seconds and can infect the person to the right or below.

SLIDE 10
When finished, ask how long it took for the whole population to be infected. The students should have more or less the same answer.

SLIDE 11
Round 2: This time ask the students to mix together 30 blue and 10 red counters and place them randomly on the grid. The red counters represent vaccinated people, **they cannot catch OR transmit the virus.**

Repeat the game, using the stopwatch to time the spread of the virus. Remind the students again that the virus can infect one person every 3 seconds and can infect the person to the right or below.

Ask the students what happened this time? Are there any blue counters left on their grid?

Round 3: This time ask the students to mix together 10 blue and 30 red counters and place them randomly on the grid.

Ask the students what happened this time? Are there any blue counters left on their grid?

SLIDE 12
Use the image on slide 14 to show how vaccinations can even protect people who are unvaccinated. *Explain that we have been using a model with a very simple grid system, where each infected person only infects two others.* ***Ask the students:*** *would the results be different if we used a model where the disease was more contagious? For example, if on our grids the disease could spread diagonally? How so? Prompt for - we would need a much higher % of the population to be vaccinated to achieve herd immunity.*

SLIDE 13
Use the image on slide 15 to explain the importance of herd immunity in terms of protecting people who cannot safely be vaccinated.

PLENARY – 5 minutes

Collect in the materials from the previous activity.

SLIDE 14
Recap vocabulary and learning using the quiz questions on the slides. Click to reveal question, then answer. Click again for next question. There are five questions in total.