Workshop title: Going Viral (KS3)
Document: Facilitator Guide

1. Overview

In this 1-hour workshop, students will participate in an **interactive simulation game** to 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 work in small groups to 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 (for class of 30)

- PowerPoint
- Facilitator Guide
- Print 20 x copies of double-sided virus/weapon card set (total of 180 cards)
- Print 20 x copies of weapons card set (total of 240 cards)
- Print 15 x grids
- Playing counters (600 x blue, 600 x green, 600 x red)
- 15 x Stopwatch

5. Step by step instructions

<u>10 mins – INTRODUCTION</u>

SLIDE 1

Introduce yourself and tell the students a little bit about your job. Explain that you are a member of the British Society for Immunology. **Ask the class**:

- 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 class 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 the class:**

- Does anyone know someone that has had measles? ***(Hands up)***
- Do you know what kind of pathogen is measles 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 the class:**

- Who has played minecraft? ***(Hands up)***
- 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.

20 mins – ACTIVITY ONE (Virus Card Game)

SLIDE 5

Explain that now they are going to play a game to find out more about how immunity works. The aim of the game is for the immune system to fight the virus as quickly as possible, before it has too much of a chance to reproduce and make the person really sick. There will be some students that are the immune system, they will have some weapon cards, and some students that are the virus. Each type of virus can only be fought by one weapon. The students playing the immune system must try out different weapon cards until they find the one that defeats the virus.

Set up

Have the virus/weapon cards in stacks (each stack with all the cards with the same virus image facing up). Hold one stack of virus cards in your hand. Have two stacks of weapon cards (with all the different weapon images shuffled together randomly).

ROUND ONE:

- Choose two volunteers to come up to the front of the class. They will be the white blood cells. Give each of them one stack of weapon cards. These represent different antibodies. They can communicate with each other.
- The white blood cell volunteers must find the right weapon card (antibody) to fight that virus. When they show it to a student playing a virus that student will sit down. Each weapon card can only defeat one virus particle, so once they have played a weapon card they should put it down on the table (creating a spent card pile).

- Choose one volunteer to stand up at their desk. They are the first virus particle. Give them a virus card from the stack in your hand.
- The student playing the virus should hold their virus card with the virus image facing out, to show the immune system volunteers the front of their card. They should not show the back of the card, which has a picture of the weapon (antibody) that can defeat them.
- When the white blood cell players show them the right weapon card they should sit down.
- Walk around the classroom and every few seconds give another student from the class the same virus card and ask them to stand up at their desk, to represent the virus reproducing.
- Once the white blood cell players find the right weapon to fight the virus, they should be able to defeat it quite quickly.

ROUND TWO:

- Once the virus has been defeated, pick up a new stack of virus cards.
- Choose two new students to be the immune system.
- Repeat - the white blood cell volunteers must now find the right weapon card (antibody) to fight this new virus.

ROUND THREE: Repeat again

ROUND FOUR: On the fourth round use a virus that has already been played in a previous round. The students (hopefully!) remember which weapon card defeated that virus, and therefore defeat the virus before it has much chance to reproduce.

FURTHER ROUNDS: Repeat for another 5 rounds, changing between new viruses and viruses that have already been played.

SLIDE 6

Ask everyone to return to their seats and collect all the cards. **Ask the class:**

- What happened once the white blood cells discovered the right antibody for the virus?
- What happened when the body was infected with a virus it had before? Why?

25 mins - ACTIVITY TWO (Zombie Virus Game)

SLIDE 7
Ask the class:

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

SLIDE 8
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 9
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 the class:***

- 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 10
Explain that now they are going to work in pairs or small groups to investigate herd immunity through a zombie virus game.

Ask the teacher to split the class into pairs or threes.

Give each group 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 11
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.

Ask the groups 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 the person below of an infected person (green counter)

SLIDE 12
When the class has finished, ask how long it took for the whole population to be infected. The groups should have more or less the same answer.

SLIDE 13
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 the person below.

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

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 14
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 15

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

05 mins PLENARY

Collect in the materials from the previous activity.

SLIDE 16

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.