Vaccine Colour-Changing Game

The vaccine game uses colour changes to show whether or not someone has been infected or protected by the vaccine! In this case our infection is a solution of baking soda and the vaccine is lemon juice. The baking powder will be neutralized by the lemon juice, resulting in a color change. This way you can tell if you are infected or not!

Our colour indicator is red cabbage. When boiled, red cabbage gives us a purple coloured indicator that will turn blue with a base (our baking powder) or pink with an acid (our lemon juice).

![Image of red cabbage indicator](image-url)

**Preparation**

You will need an indicator, a solution of sodium bicarbonate (baking powder), a solution of lemon juice, vials to put them in and droppers to mix the liquids during the game. A whiteboard and some colored markers are also helpful for explaining the results.

**Infection solution:** approx. 4mg of sodium bicarbonate (baking powder) in 50 ml of water

**Vaccine solution:** Lemon juice.

**Indicator:** Take one leaf of red cabbage and put it in a food processor with approx. 2 cups of water. Blend it until the water turns purple. Strain out the left over bits of cabbage and put the liquid in the fridge.

**NB the indicator is best used within 2 days and should be kept in the fridge as it will give off a strong smell!**

**Other components needed:**
- Pasteur pipettes or droppers (at least 5 for the children, 1 for the infection liquid, 1 for the vaccine liquid and 1 for the indicator)
- Clear plastic vials, at least 8-10ml ml. You will need at least five for the game.
- White boards with red, black and blue markers.
- A bucket for dumping waste liquid after each result.
- Tissue paper for cleaning up spills!
Learning Objectives

- What is immune memory?
  - When the immune system sees a germ that it remembers, it can kill it quicker, which prevents.
- What is a vaccine?
  - A bit of germ/bacteria that is given so the immune system is given immune memory.
- What is “herd immunity”
  - Even if not everyone is vaccinated, some vaccinated people can stop the spread of the disease.

Step 1: Explain the game
Set-up: 1 pre-infected cup, 1 vaccinated cup

- Introduce game, “We are going to show how infection can spread from person to person”
- Show an infected cup of clear liquid (Base) and a non-infected cup of clear liquid (Acid).
- Explain we have an indicator to tell whether it is infected or not. Blue for infection, pink for not infected.
- Add indicator and show the infected and non-infected cup are different colors.

Step 2: Show spread of infection
Set-up: 5 vials of water (~3mL) given to kids. Diagram on white board. Red and blue markers.
• Ask kids how they think a flu or a cold can spread.
• Explain that a flu can spread by coughing and sneezing. We are replicating this by mixing our vials of water.
• Set up one 2 lines of 2 children with 1 child as the “patient zero” as seen below.
• Give everyone a vial of water.
• Take ~2mL of your Infection solution and add it to the first child in line.
• liken this mixture to something like sneezing on his friends in school!
• Get the patient zero to take ~2ml (or a Pasteur pipette full) of their vial and add it to the next two children in line, as shown in the diagram below.
• Tell the two children to mix there vials and take ~ 2ml of liquid and pass it back to the next in line.
• Explain to the children that no-one has received a vaccine, and everyone has come in contact with this disease for the first time. Who do they think is infected?
• Add the indicator (ask for a helper) to each vial and give a brief explanation on how it spreads and mark the infections on diagram (above).

This is to show that if encountering a bacteria for the first time, without a vaccine, a disease can spread.

Step 2: Show how a vaccine can stop the spread of infection.
Set-up: 5 vials of water. Diagram on white board. Red and blue markers.

- Explain how a vaccine can stop the spread of infection. By giving immune memory you can stop the bug/bacteria from causing the cold or flu.
- After setting up the lines of children and giving them water. Give each child ~2.5 ml of your “vaccine”
• Take ~2mL of your Infection solution and add it to the patient zero.
• Get the patient zero to take ~2ml (or a Pasteur pipette full) of their vial and add it to the next two children in line, as shown in the diagram.
• Tell the two children to mix there vials and take ~ 2ml of liquid and pass it back to the next in line.
• Explain to the children that everyone has received a vaccine. Who do they think is infected?
• Add the indicator to each vial and give a brief explanation on how it spreads and mark the infections on diagram (above).

This is to show that even if someone is encountering a bacterium for the first time, if they have been vaccinated they will be protected.

Step 3: Show how more vaccinated people can stop the spread of infection.

Explain herd immunity.

Set-up: 1 pre-infected cup (Base), 2 cups of vaccine (acid) given to first kids in one of the lines. Diagram on white board. Red and blue markers.

![Diagram](image)

• Ask if less children are vaccinated then what would happen? Why would this happen? Do they think everyone would get sick if only a few were vaccinated?
• Set up one 2 lines of 2 children with 1 child as the “patient zero” as seen above.
• Give ~ 2.5ml of vaccine to the one child as shown in the diagram.
• Take ~2mL of your Infection solution and add it to the patient zero.
• Get the patient zero to take ~2ml (or a Pasteur pipette full) of their vial and add it to the next two children in line, as shown in the diagram.
• Tell the two children to mix there vials and take ~ 2ml of liquid and pass it back to the next in line.
• Explain to the children that everyone has received a vaccine. Who do they think is infected?
• Add the indicator to each vial and give a brief explanation on herd immunity and mark the infections on diagram (above).

This will show that herd immunity can protect un-vaccinated individuals by curbing the spread of disease.