The Royal College of Pathologists
Pathology: the science behind the cure

Vaccines & Antibiotics
Activity Guide

Equipment:

- 3ml pipettes
- Vinegar
- Bicarbonate of Soda (made up into a solution with water)
- Bromothymol Blue (made up into a solution with water)
- Marker pens to label containers
- Marker pens to use on laminated antibiotic results table
- Plastic shot glasses or plastic test tubes (can be rinsed and reused)
- Clear cups (to act as 'pox' reservoirs)
- Agar plates without any pathogens, or with safe pathogens (optional)
- Empty petri dishes
- 30cm rulers
- Laminated images of agar plates with bacterial growth
- Laminated tables of cut off zone measurements

Set up

Vaccine Activity set up:

- Make up the solutions in 3 clear cups as follows:

  1) **Vinegar:** Distilled malt vinegar (colourless) neat from the bottle. Label as 'Cowpox'
  2) **Bicarbonate of soda:** Add 2 heaped teaspoons to cup of water and mixed until dissolved. Label as 'small pox'
  3) **Bromothymol blue:** Add about 2ml to the cup of water. Label as 'Indicator'

- Label a set of plastic shot glasses each with the following labels: 'Person A', 'Person B'

- 'Person A' and 'Person B' shot glasses can be given actual names, as these represent two people. Only one of these 'people' will be vaccinated against smallpox (i.e. given some cowpox pus), but both 'people' will be then infected with smallpox.

Example of set up of vaccine activity

Antibiotic Activity Set up

If you wish to run the antibiotic activity also, lay out or distribute the sets of cards, with no information filled in, some rulers and the pens.

Background:

With the medical innovations that took place around the time of the war, we have now established methods to cure us from infection. Two of these methods are administering antibiotics and vaccinations.

Smallpox is a contagious infectious disease caused by the Variola virus. It was eventually eradicated in 1977, but caused millions of deaths worldwide. In the late 18th century, physician Edward Jenner noticed that milkmaids exposed to the mild infection from cowpox rarely caught smallpox. He took cowpox pus from the hand of a milkmaid and introduced it to scratches on the hand of an eight-year old boy, James Phipps. The boy developed a mild illness but did not develop smallpox when exposed to the virus on several occasions. This was disease prevention: it meant one disease could be prevented by exposure to another.

During the 20th century, antibiotics were developed and were treated as a miracle. Before the introduction of antibiotics an infected cut could kill. However, not all bacteria are susceptible to antibiotics, different bacteria respond to different antibiotics and bacteria can become resistant to antibiotics that they previously responded to. Antibiotic discs ensure that the correct antibiotic is used.

Bacteria are grown on agar plates, a thin layer of nutrient gel in a petri dish. We now have plastic petri dishes (lighter and easier to stack than glass ones). An antibiotic disc is a small, circular piece of filter paper which has been soaked in an antibiotic solution and dried. Microbiologists study antibiotic sensitivity by placing antibiotic discs on a prepared agar plate and incubating it with the bacteria to test. The antibiotic seeps out of the discs and kills susceptible bacteria in the area around the disc. The bigger the zone without bacterial growth, the more effective the antibiotic. Some bacteria grow all the way up to the disc, indicating that that particular antibiotic is not effective against the bacteria.

The vaccination activity uses a simple acid-alkali reaction with indicators to simulate vaccination. The antibiotic activity asks attendees to pick which antibiotic would best to cure them after inspecting a series of antibiotic disc-containing agar plates. Pathologists will show them the plates and ask them which antibiotic will be most effective.

Vaccine Activity Instructions:

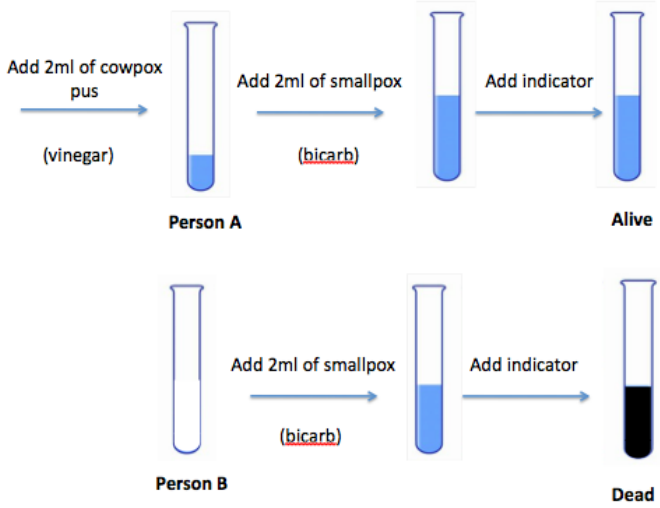
- Using a pipette ask attendees to vaccinate 'Person A'. Ask them to add 2ml of 'Cowpox Pus' (vinegar) to the 'Person A' glass.

- Now both 'Person A' and 'Person B' are going to be subjected to smallpox. Ask attendees to add 2ml of 'Smallpox' (bicarbonate of soda) to both 'people'.

- 'Person A' will have started fizzing (i.e. something is working with the vaccine!). Ask attendees to add 2ml of the indicator to indicate who is still healthy and alive, and who is infected and likely to die.

- Result: 'Person A' glass should remain colourless, whereas 'Person B' will turn blue, indicating that 'Person B' has got smallpox and will die. Cup on the left (vaccinated person), cup on right (non-vaccinated person):

- Explain to attendees that this simulates what Edward Jenner did when he came up with the smallpox vaccine. By adding a small amount of the disease-causing microbes (cowpox pus) which cause a mild reaction in healthy people, it made these people less likely to suffer the consequences of smallpox, and they would survive.



Antibiotic Activity Instructions:

- Pathologists/volunteers to show attendees empty petri dishes, agar plates, antibiotic discs and diagrams of clear zones.

- Pathologists/volunteers to explain the use of antibiotic discs and antibiotic susceptibility testing as per the laminated guides

- Volunteers to ask attendees to measure with rulers, the clear zones on the scale images and fill in the tables with the results. They can then use the information provided to work out which bacteria is resistant, and which is susceptible to the antibiotics given. (if time is short there are cards which include the measured zones so they can just use this to work out which antibiotic should be used. Otherwise these cards should be kept separately)

- The cards can be wiped clean of their answers and reused.