



Key Stage 3

# Antibiotic Use and Antimicrobial Resistance: Teacher Guidance

## Background information

We have already learned in the vaccinations lesson plans that the majority of the time, the immune system defeats any harmful microbes entering the body, however, in some cases the immune system needs help. Antimicrobials are medicines used to kill or slow the growth of microbes and antibiotics are special medicines used by doctors to kill harmful bacteria. Some antibiotics stop the bacteria reproducing and others kill the bacteria. Antibiotics treat infectious diseases caused by bacteria, such as meningitis, tuberculosis and pneumonia. They do not harm viruses, so antibiotics cannot treat diseases such as colds, flu and COVID-19, which are caused by viruses. Examples of antibiotics are penicillin, clarithromycin, doxycycline and amoxicillin.

Before antibiotics were invented, harmful bacteria were life threatening e.g. bacteria picked up during childbirth or routine surgery. Today, however, many bacterial infections are easily treated with antibiotics – but bacteria are fighting back. Through increased exposure to the antibiotics, bacteria are becoming resistant to them. This means that bacterial infections are once again becoming life threatening.

There are a number of ways in which we can help prevent this happening:

- Only use antibiotics prescribed for you by your doctor or healthcare professional, because the antibiotic and dose would have been specifically chosen for the type of infection you have and for your body.
- Always finish the course prescribed otherwise the bacteria are not completely destroyed and the infection is more likely to come back.
- Don't use antibiotics for common coughs and colds because these are usually caused by viruses and antibiotics do not kill viruses. Using antibiotics when they are not needed increases the chance of bacteria developing resistance which could later harm you and others.

Infections caused by antibiotic resistant bacteria pose a serious health risk. These bacteria may have resistance to one or more antibiotics, meaning that the first and/or second choice of antibiotic may not work. This results in fewer options for treating you or your family or friends or someone else and the infection may be more difficult to control and risk overwhelming our immune system. Resistant bacteria can pass their resistance on to other bacteria.

# Growth of Bacterial Lawn Advanced Preparation

The following preparation is for 1 group of 5 students

## Materials Required

Petri dishes  
Hydrochloric acid  
Wax Crayon/marker  
Base Agar  
5 Test tube racks  
Cork borer  
Phenol Red  
20 Test tubes  
Disposable droppers  
Hot plate

## Agar Plate Preparation

1. Make up 100ml of base agar following the manufacturer's instructions.
2. When cooled slightly, but not solid, pour 1 agar plate (to demonstrate no growth). When complete add enough (~10 drops) 2 – 4% Phenol Red to turn the agar a deep red/dark orange and mix well.
3. Pour approx 20ml into each petri dish and leave to cool.
4. When solidified, make 5 evenly spaced bore holes in each agar plate.
5. Label each Petri dish with Patient A, B, C and D

## Antibiotic (test-tube) Preparation

1. Set up a test tube rack of 5 test tubes for each patient. Label each test tube with one of the following labels a. Penicillin b. Meticillin c. Oxacillin d. Vancomycin e. Amoxicillin
2. Transfer 5ml of the following solutions into the appropriately labelled test tube

Patient	Pencillin	Meticillin	Erythromyocin	Vancomycin	Amoxicillin
A	Water	Water	Water	Water	Water
B	10% HCl	5% HCl	1% HCl	0.05% HCl	5% HCl
C	Water	Water	1% HCl	0.05% HCl	Water
D	Wate	0.05% HCl	0.05% HCl	0.05% HCl	Water

NB: It is extremely important to have the correct concentrations of HCl (antibiotics) for each patient.

3. Set up a work bench for the group as follows:
  - a. Place the appropriate patient's agar plate next to each corresponding rack of test tubes at 4 stations across the bench
  - b. A dropper for each test tube
  - c. A ruler with mm markings
  - d. It may be easier for students if they place each patient's agar plate on a piece of white paper and label the paper next to each bore hole with the antibiotic name.

# SW2 and SW3 (Differentiated) Conclusions Worksheet

## Answers

1) Antibiotics don't cure the cold or flu, what should the doctor recommend or prescribe to patient A to get better?

Antibiotics can only be used to treat bacterial infections; the cold or flu is caused by a virus. The doctor should prescribe medicines to help with the symptoms.

2) Methicillin used to be used to treat a *Staphylococcal* infection, what would happen to Patient C's infection if they had been prescribed Methicillin?

Nothing. MRSA is resistant to antibiotics.

3) If you had some amoxicillin left over in your cupboard from a previous chest infection, would you take them later to treat a cut on your leg that got infected? Explain your answer.

No, you should never use other people's antibiotics or antibiotics which have been prescribed for a previous infection. There are many different types of antibiotics which treat different bacterial infections. Doctors prescribe specific antibiotics for specific illnesses and at a dose suitable for that patient. Taking someone else's antibiotics may mean your infection does not get better.

4) Patient D doesn't want to take the prescribed flucloxacillin for their wound infection. *"I took more than half of those pills the doc gave me before and it went away for a while but came back worse."* Can you explain why this happened?

It is very important to finish a course of prescribed antibiotics, not just stop halfway through. Failure to finish the course may result in not all the bacteria being killed and possibly becoming resistant to that antibiotic in future.