



3.0 Antibiotics and Medicine

Lesson Plan

Advance Preparation (30 min)

1. Collect a variety of items which are considered medicines, these may include painkillers, aspirin, cough and cold remedies, honey, antibiotics, antiseptic creams, peppermint tea, vitamins, orange juice, ginger, probiotic drinks, etc.
2. Download the e-Bug Antibiotics and Medicine presentation at www.e-bug.eu.

Introduction (15 min)

1. Display the range of food and medicine on the counter. Ask students what their definition of medicine is. Explain that the term medicine has been defined as *a substance or preparation affecting well being, used in maintenance of health and prevention, alleviation or cure of disease* (Webster's dictionary).
2. Ask the students to divide the items into 2 groups, one which they think is medicines and one which isn't. The class will probably divide the items into industrial medication and food stuffs. Explain that many food stuffs can also have medicinal properties (honey can be used as an antibacterial agent - many people believe that honey helps cure a sore throat. Peppermint tea aids in digestion, ginger also has antibacterial properties and orange juice contains high quantities of vitamin C) and many industrial medicines are based on these food sources.
3. Highlight to the class that eating a healthy diet can help prevent us being ill and avoid having to visit the doctor, e.g. it is thought that regular intake of vitamin C can help reduce the incidence of the common cold.
4. Emphasise to the class that medicines should only be used for the illness they were intended. Ask students what they think antibiotics should be used for. Highlight that antibiotics are **ONLY** used for bacterial infections and that they do not work on virus or fungal infections.
5. A presentation has been provided on www.e-bug.eu on the discovery and use of antibiotics.

Main Activity (25 min)

1. This activity should be carried out in small groups of 3-5 students
2. Provide students with a copy of [SH 1](#), [SW 1](#) and [SW 2](#).
3. The story in [SH 1](#) can either be read to the students (display on a white board or overhead projector may be beneficial) or students can read the story in their own groups.
4. Students should then complete [SW 1](#) and [SW 2](#).

SW 1 Answers

1. Why would Dr Lai find it necessary to carry out the control tests? *Controls are important in any scientific test. By observing how the bacteria grow under normal conditions and how they grow in the presence of antibiotics Dr Lai will be able to recognise the growth pattern when he tests other antibiotics.*
2. What happens to the bacteria in each of the diagrams?
 - a. *The bacteria are growing and multiplying*
 - b. *The antibiotics have killed all bacteria straight away*
 - c. *The antibiotics look as if they are killing all the sensitive bacteria for the first 6 hours but the resistant bacteria continue to multiply in the antibiotic.*
3. What happens to the bacteria in Figure 3? *As 'c' above*
4. Can you explain why this is happening? *The antibiotic is killing all the sensitive bacteria in the culture. But resistant continue to multiply and after 6 hours have increased in number.*





3.0 Antibiotics and Medicine

Lesson Plan

Main Activity (25 min)

SW 2 Answers

5. Describe what is happening to the bacteria populations in each of the graphs?
 - a. *The antibiotic appears to have stopped the bacteria multiplying so the growth is static for the first 10-12 hours. A continual gradual decline in bacterial numbers is then observed in bacterial numbers. Not all of the bacteria is killed after 24 hours. The antibiotic is described as bacteriostatic.*
 - b. *Following administration of the antibiotic a rapid decrease in bacterial numbers occur.*
 - c. *The bacteria show a rapid decline in the first 11 hours following antibiotic administration. The numbers however start to increase after this time and continue to multiply as normal.*
6. Do you think the bacteria making Harry ill are antibiotic resistant? Explain.
Yes, although antibiotic 1 and antibiotic 2 do appear to kill the bacteria, the antibiotic in figure 3 doesn't. It appears to have a killing effect on the bacteria for 11 hours but then the bacteria start to multiply again. This suggests that the bacteria are resistant to antibiotic 3.
7. Which antibiotic should the doctor prescribe Harry to eliminate the infection and why?
The doctor should prescribe antibiotic 2 to Harry. Harry is getting very ill and needs to clear the infection as soon as possible so a fast acting antibiotic is preferable.
8. What could Harry have done to prevent getting the infection?
 - a. *He should have finished the first course of antibiotics prescribed*
 - b. *He could get the wound regularly washed and dressed*
 - c. *Alternatively, he may have picked up the resistant microbe in the hospital out of no fault of his own*

Plenary (15 min)

3. Discuss with the class their opinion on antibiotics under the following heading
 - a. When should they be taken?
 - b. Should we take other people's antibiotics?
 - c. How we are responsible for antibiotic resistance
 - d. What we can do to prevent more bad bacteria becoming antibiotic resistant

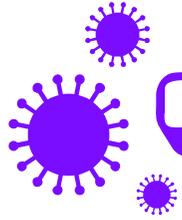
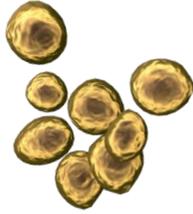
Extension Activity

5. Divide the class into groups. Ask each group to create a poster on 1 of the following topics
 - a. Due to media attention MRSA is one of the most commonly known antibiotic resistant bacteria. What is being done in hospitals to tackle this problem?
 - b. *Clostridium difficile* has been described as the new 'superbug', what is *C. difficile* and how is it being treated.
 - c. How have antibiotics been used in areas outside human health?

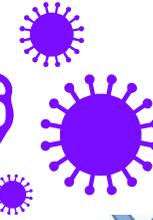




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Harry had to go into hospital to get his appendix removed. After surgery, everything seemed to be going well, Harry appeared to be recovering normally and was sent home. The doctor, Dr Lai, prescribed him a single dose antibiotic for prophylactic reasons (to prevent any infection occurring).



One week later Harry started to feel unwell, he felt tired and nauseous and had pain around his surgical wound. His mother took him to visit their family doctor, Dr Williams, who, after examining Harry, thought that the wound might be infected and prescribed him a second course of antibiotics with a warning to finish the course.



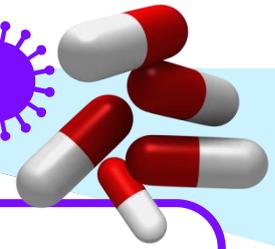
Three days later, Harry did not feel any better. He had a high temperature and his surgical wound was really hurting now. This time Dr Williams sent Harry to hospital for a more thorough examination. After taking some blood tests Dr Lai discovered that Harry had a serious bacterial infection but did not know which bacteria was causing the infection although it appeared to be *Staphylococcus aureus*. He saw that Harry had previously been administered some antibiotics which did not appear to be working and feared that he might have contracted an antibiotic resistant organism or a 'superbug'.



Dr Lai decided that administering more antibiotics to Harry might cause more harm than good. He thought that he needed to test a variety of antibiotics on the pathogenic organism before he administered any to Harry. Dr Lai decided to try out two different tests.



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Test 1

Dr Lai grew some laboratory grown *Staphylococci* similar to the strains that were infecting Harry in 3 different test tubes. These are known as controls.

- Test tube 1 – The bacteria with growth media alone
- Test tube 2 – The bacteria with antibiotics known to inhibit the growth of that bacteria
- Test tube 3 – Bacteria known to be resistant to the recommended antibiotics

Results

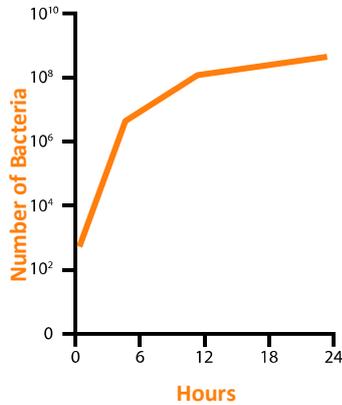


Figure 1. No antibiotic.

The growth of bacteria if NO antibiotics are used.

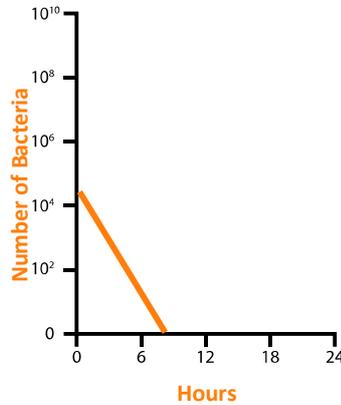


Figure 2. Antibiotics and sensitive bacteria.

The growth of bacteria with active antibiotics.

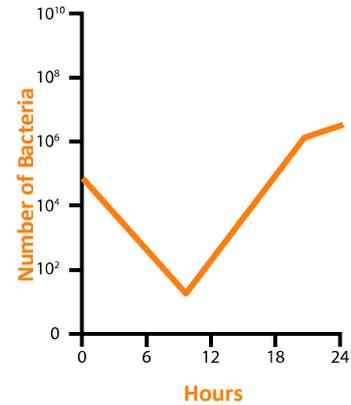


Figure 3. Antibiotics with sensitive and resistant bacteria.

The growth of resistant bacteria in the presence of antibiotics

Conclusions

1. Why would Dr Lai find it necessary to carry out these control tests?

2. What happens to the bacteria in each of the diagrams?
 - a. _____
 - b. _____
 - c. _____

3. What happens to the bacteria in figure 3?

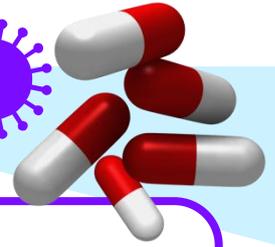
4. Can you explain why this is happening?





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Test 2

Dr Chung grew some of the bacteria causing Harry's infection in 3 different test tubes and added a different antibiotic to each of the test-tubes. He grew the cultures for 24 hours taking bacterial counts every six hours. The results are shown below.

Results

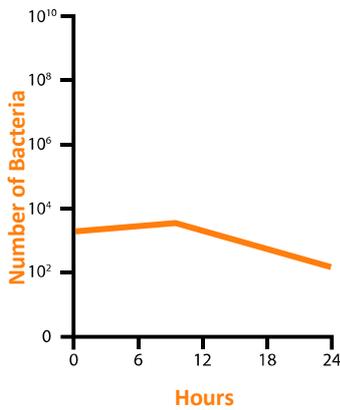


Figure a. Antibiotic 1

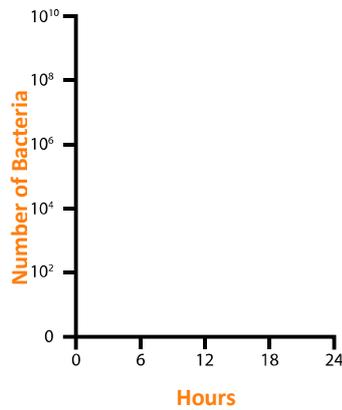


Figure b. Antibiotic 2

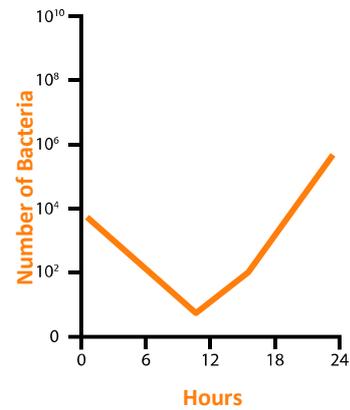


Figure c. Antibiotic 3

1. Describe what is happening to the bacterial populations in each of the graphs above



- a. _____
- b. _____
- c. _____

Conclusions

1. Bacteria can be resistant to one or many different antibiotics. Do you think the bacteria making Harry ill are antibiotic resistant? Explain your answer.

2. Which antibiotic should the doctor prescribe Harry to eliminate the infection and why?

3. What could Harry have done to prevent getting the infection?
