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STEM Project

Chapter 6: Cells

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How clean are your hands?

Bacteria are organisms that are made up of only one cell. They reproduce very quickly by splitting into two – a process called binary fission. This reproduction process can take just minutes to occur, meaning one bacterial cell can turn into millions of cells in a few hours.

Some bacteria are harmless, or even helpful, to humans. However, there are also bacteria that are harmful and dangerous. Bacteria is responsible for infections such as pneumonia, meningitis and food poisoning.

It is important that harmful bacteria on our bodies are minimised to reduce the risk of them getting inside us and making us sick. The primary method of reducing harmful bacteria on the skin is simply by cleaning ourselves. Keeping our skin clean is vitally important in places such as hospitals where there are people who are in a weakened condition or have wounds that make them susceptible to a bacterial infection.

In this activity, you will be asked to advise the manager of a hospital which method of hand cleaning should be enforced to minimise the risk of bacteria breeding. You will compare three methods of hand cleaning to find out which is most effective.

This activity is best done as a group.

Experiment – Investigation of hand-cleaning methods

Aim: To find the most effective hand cleaning method

Materials:

- 4 prepared agar plates and lids
- 4 cotton swabs
- Water
- Soap
- Antibacterial gel
- Camera

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Method:

1 Choose one member of your group to be your subject. They will provide bacteria samples from their hands.

2 Using the first cotton swab, rub the palm of the subject's right hand with the swab and then gently rub the swab on the first agar plate. Replace the agar plate lid securely and label it: 'control – no cleaning'.

3 Next, help your subject clean their right hand with soap and water. Using another cotton swab, rub the palm of the subject's right hand again and then gently rub this swab on the second agar plate. Replace the agar plate lid securely and label it: 'soap and water'.

4 Next, help your subject clean their left hand with antibacterial gel. Using a third cotton swab, rub the palm of the subject's left hand and gently rub this swab on the third agar plate. Replace the agar plate lid securely and label it: 'antibacterial gel'.

5 Now, help your subject clean their right hand again, this time with antibacterial gel.

6 Using the last cotton swab, rub the palm of the subject's right hand again and gently rub this swab on the last agar plate. Replace the agar plate lid securely and label it: 'soap and water plus antibacterial gel'.

7 Check your petri dishes every two days and record photos of any bacterial growth you observe.

Data and results

Place photos of the bacteria growth in the petri dishes in the spaces below. If you need more space, use a separate sheet.

Petri dish photos	Growth after 1 day	Growth after 3 days	Growth after 5 days	Growth after 7 days
1 Control – no cleaning				
2 Soap and water				
3 Antibacterial gel				

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4 Soap and water plus antibacterial gel				

Your photos display the growth of bacteria pictorially (in pictures). You could also display this data numerically by estimating the percentage of the agar plate surface area covered with bacteria.

Translate your photos into surface area percentage estimates and enter your estimates into the table below. To assist you to make an estimate, lay a square grid over your photos and count the squares that are covered by bacteria compared to those that are not.

Surface areas covered (%)	Growth after 1 day	Growth after 3 days	Growth after 5 days	Growth after 7 days
1 Control – no cleaning				
2 Soap and water				
3 Antibacterial gel				
4 Soap and water plus antibacterial gel				

Discussion and reflection

1 What is the purpose of the control petri dish?

2 Rank the three hand-cleaning methods from least effective to most effective.

What would be your recommendation to the manager of a hospital in relation to the best method of cleaning hands?

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3 Compare your results of those in other groups. How are they similar or different?

4 What variables can you think of that were not controlled in this experiment? How could they have affected your results?

5 Imagine that soap costs 25 cents per wash and antibacterial gel costs 35 cents per wash. The hospital is on a tight budget and any money saved can go towards saving patients. They want to minimise cost, but not jeopardise cleanliness. What would you advise?

6 Now imagine these costs reversed: soap costs 35 cents per wash and antibacterial gel costs 25 cents per wash. How, if at all, would your advice change?

Extension activity: Antibiotics and super-bugs

Once harmful bacteria have made their way inside our bodies, one of the most common ways to reduce the harmful effects is to use antibiotic medication. However, the high use of antibiotics to treat infections, along with the speedy reproduction rate of bacteria, has meant that some bacteria have evolved into 'super-bugs' that are almost impossible to kill with regular antibiotics.

Investigate the emergence of 'super-bugs' by examining how they have evolved and make a statement about what they could mean for human health in the future.

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