

### OVERVIEW

Aimed at **key stage 4** pupils. Pupils will learn about the way mucus accumulates in the lungs of people with cystic fibrosis and produce homemade mucus.

### LEARNING OBJECTIVES

- To understand that mucus performs an important role in the lungs to keep them clear and clean
- To realise that people with cystic fibrosis have sticky, thick mucus in their lungs which causes problems
- To appreciate that mucus provides an ideal environment for bacteria to grow and people with cystic fibrosis often have infections in their lungs

### CURRICULUM LINKS

- KS4:** The ways in which organisms function are related to the genes in their cells
- KS4:** Human health is affected by a range of environmental and inherited factors, by the use and misuse of drugs and by medical treatments

### you will NEED

#### For 30 students:

- 300ml PVA glue
- 300ml water
- 150ml of 5% borax solution (made by mixing 7.5g of borax power with 150ml of water)
- 15 disposable cups, splints (for stirring), Pasteur pipettes
- Bottle of green and/or yellow food dye

### PREPARATION

- Make up a solution of 5% borax (powder used as a cleaning product). Alternatively, you could get the pupils to make up this solution themselves.
- Organise the materials needed for each pair.

### Activity

- Introduce cystic fibrosis and find out what the pupils already know about this genetic condition
- Explain that the lungs are one of the main areas affected by cystic fibrosis
- Show the film Ryan's story on [www.genesareus.org](http://www.genesareus.org)
- Give out worksheets and the practical equipment for mucus-making
- Instruct pupils to make the mucus and then answer the questions on the worksheet
- Note:** Health and safety: PVA glue and borax are not hazardous materials, but pupils should wash their hands after the practical

## ANSWERS

### 1. Describe what happened as you added the 5% borax solution.

As the borax solution is added the runny mixture becomes thicker and more solid.

### 2. Explain why you think sticky mucus could cause problems in the lungs

It causes a number of problems:

- a) It blocks areas of the lungs – sometimes airways become blocked with mucus;
- b) It is hard to clear the sticky mucus and it does not move around the lungs as it should;
- c) Bacteria grow on the clogged up mucus, which can lead to infections;
- d) Repeated lung infections cause serious damage to the lung tissue.

### 3. What substance is prevented from moving across the cell membrane in people with CF?

Salt (pupils might also say chloride ions, which is correct).

### 4. Why is the mucus in the lungs a good place for bacteria to grow?

This provides the ideal conditions for many bacteria to grow with warmth, moisture, neutral pH and a food source (the sugary mucus).

### 5. Name three things that people with CF can do to keep their lungs in good health.

Main points: daily exercise, physiotherapy and taking medicines (for example, antibiotics and drugs to thin the mucus).

Pupils might also mention eating a healthy diet, visiting a doctor regularly or reducing exposure to infections by avoiding situations where they might meet people who are unwell.

### 6. What are the consequences of having repeated bacterial infections in your lungs?

The lung tissue can be badly damaged after repeated bacterial infections. This reduces the lung function and when lung function becomes very poor, a lung transplant is recommended.

## FURTHER INFORMATION

- ★ The CF Trust provides excellent information about the condition [www.cftrust.org](http://www.cftrust.org).
- ★ An American website called 'Your Genes, Your Health' has animations and films to explain the cause of CF, inheritance, etc. It is pitched above GCSE-standard but would be accessible to able pupils [www.ygyh.org](http://www.ygyh.org).
- ★ The 'Changing Futures' website has been made with teenagers affected by CF to explain aspects of the condition and explore the potential of gene therapy [www.changing-futures.co.uk](http://www.changing-futures.co.uk).

FOR MORE RESOURCES, GO TO [WWW.JEANSFORGENES.ORG](http://WWW.JEANSFORGENES.ORG)

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# MAKING MUCUS

You might not think about snot and mucus often, but it is very important. It helps different parts of your body function, but we are going to focus on its role in the lungs. Mucus lines your lungs to protect them from foreign objects (such as dust, bacteria and pollen.) Mucus is usually a clear liquid and it moves continuously around your lungs in order to get rid of foreign objects.

We generally only become aware of mucus when we have a cold and we have to blow our noses or sneeze. We often find that the mucus

becomes thick and yellowy-green when we have an infection. We produce mucus in other parts of our body too and in total an average person makes about a litre of mucus every day!

You are now going to make some homemade mucus. In your body, mucus is mainly made of water, protein and sugar. These chemicals give the mucus its properties of being stretchy and slimy. We are going to use different materials to make mucus, but it will have similar properties.

## INSTRUCTIONS

- Mix approximately 20ml of PVA glue with 20ml of water and stir
- Add a few drops of green or yellow food dye and stir
- Use a Pasteur pipette to add 1ml of 5% borax solution and stir
- Add another 1ml of 5% borax solution and stir
- Continue to add 1ml of 5% borax solution until 10ml has been added.

- 1 Describe what happened as you added the 5% borax solution.
- 2 Explain why you think sticky mucus could cause problems in the lungs

People with cystic fibrosis (CF) have problems with the mucus in their lungs. This genetic condition prevents the movement of salt across the cell membrane and this leads to a thick, sticky mucus building up. This sticky mucus does not move around the lungs as it should and it can accumulate. People with CF often have persistent coughs and can be short of breath. The build up of mucus in the lungs can sometimes block airways. Exercise and daily physiotherapy is recommended for people with CF to help dislodge the mucus and keep their lungs in good health. There are also

some medicines that people with CF can take to thin the mucus.

The sugar in mucus makes it an ideal breeding ground for bacteria. People with CF are vulnerable to bacterial infections in their lungs and they need to take antibiotics to help protect them. However, they still get lung infections and over time these lung infections can cause serious damage to the lung tissue. People with CF sometimes need a lung transplant if their lungs have been very badly damaged.

- 3 What substance is prevented from moving across the cell membrane in people with CF?
- 4 Why is the mucus in the lungs a good place for bacteria to grow?
- 5 Name three things that people with CF can do to keep their lungs in good health.
- 6 What are the consequences of having repeated bacterial infections in your lungs?

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