

● ○ ○ EASY

6-12

1 HR
plus a week
to observe



1 Learn about the
work of Dr Frederick
S. McKay

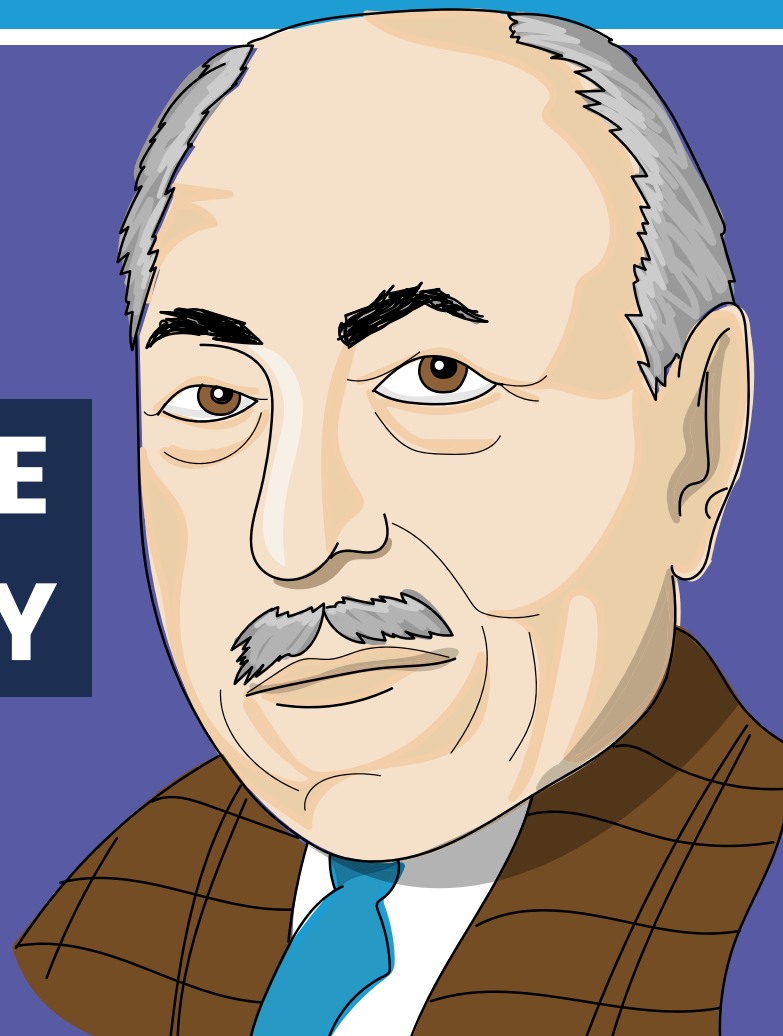
2 Investigate the
effect of fizzy drinks
on eggshells

3 Find out why fizzy
drinks are acidic

STORIES IN CHEMISTRY

FANTASTIC FLUORIDE AND FRIGHTFUL FIZZY DRINKS

Illustration: Dr Frederick S. McKay



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INTRODUCTION

Dr Frederick S. McKay was a dentist who discovered that the chemical fluoride prevents tooth decay.

Frederick McKay was born in the US in 1874. As a young man he worked in his father's shop. When he was 20, he became ill with tuberculosis. He partially recovered and was later encouraged to study dentistry.

In 1901, he moved to Colorado Springs to work as a dentist. He noticed that in certain villages, almost all of the children had brown stains on their teeth. He also discovered that in areas where lots of people had the brown tooth staining, there seemed to be little or no tooth decay. His colleagues didn't think his discovery was important.

Dr. McKay eventually found that staining of the tooth enamel was caused by natural fluoride in the local drinking water. During the late 1930's it was proven that adding fluoride to water supplies prevents tooth decay.

Modern toothpastes now contain fluoride, which prevents tooth decay.



DID YOU KNOW?

Tooth decay happens when bacteria in your mouth produce acids that erode the teeth. Bacteria loves sweet foods – so eating less sugary foods can reduce tooth decay. Tooth enamel can also be eroded by acids from food and drinks. Fluoride strengthens tooth enamel, making it more resistant to acid attacks.

SAFETY

- **Do not ingest anything from this science experiment.**
- **Always wash hands after touching raw eggs.**
- **Ask an adult to dispose of the eggs and liquids safely at the end of the experiment.**

ACTIVITY

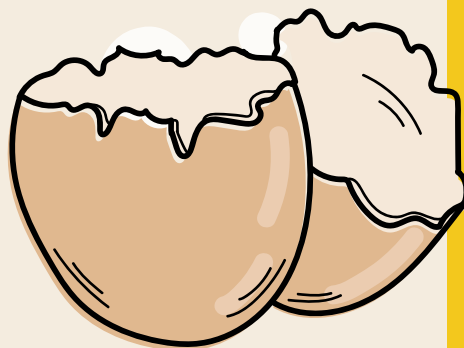
INVESTIGATING THE EFFECT OF FIZZY DRINKS ON EGG SHELLS

To commemorate the work of Dr Frederick S. McKay, the experiment below will show you how fizzy drinks can contribute to tooth erosion and decay.

INSTRUCTIONS

1. Label the 4 jam jars "cola", "lemonade", "vinegar" and "water".
2. Fill the jam jar labelled "cola" almost to the top with cola. Over a sink (to prevent spills), gently drop one of the eggs into the cola without breaking the egg. Ensure the jam jar is filled to the top with cola.
3. Repeat step 2 with lemonade in the jar labelled "lemonade", tap water in the jar labelled "water", and vinegar in the jar labelled "vinegar".
4. Loosely cover the jam jars with the lids, but don't tighten the lids.
5. Leave the jam jars for a week. After a week, observe the colour of the eggs – have they discoloured? If you gently scrape the egg with a fork, does the egg shell coating scrape away? You may notice a change of texture – do the eggs feel firm, or soft and rubbery?

For closer inspection, ask an adult to gently pour the contents of each jar through a sieve. It may get messy so make sure you do this over a sink!



YOU WILL NEED

- 4 jam jars (with lids)
- 4 eggs (medium or small to fit in the jam jars)
- 250ml bottle of carbonated lemonade (look for one containing citric or malic acid)
- Fork
- 250ml bottle of carbonated cola (look for one containing phosphoric acid)
- 250ml white vinegar
- Marker pen to label jam jars
- Sieve

WHAT'S HAPPENING?

Fizzy drinks contain lots of dissolved **carbon dioxide**, which turns into bubbles when the bottle is opened. **Carbon dioxide** dissolved in water forms a chemical called **carbonic acid** – so all fizzy drinks are acidic. Vinegar is actually a chemical called acetic acid, which is more acidic than fizzy drinks. Plain water is not acidic.

Egg shells and teeth are made from similar chemicals (both contain calcium) which behave in a similar way when mixed with acids. A chemical reaction occurs where the chemicals are slowly used up in the reaction, causing egg shells (or teeth) to weaken and erode.

The shell of the egg placed in lemonade or cola may be thinner and scraped away with a fork. The egg left in vinegar may have a soft, rubbery appearance. Sometimes the shell is completely dissolved away, turning the egg into a round ball. The tap water egg should appear unchanged.