



MRC Centre
for Medical
Mycology



University
of Exeter

Fungi are Alive!

Junior Mycologist Experiments

The activities in this pack are ideal for primary aged children and are fun to do with family or at school.

What are fungi?

Fungi are a group of living things that are found everywhere in the world.

They live on land, in the air, and they even live on our skin and inside our bodies.

Some fungi (like the ones that live on us and inside us), are so incredibly tiny that you would need a microscope to see them, and some fungi are absolutely enormous!

In fact, the largest living thing on planet earth is thought to be a honey fungus measuring

2.4 miles (3.8 km) across in the Blue Mountains in Oregon, USA. That's longer than 15 football pitches laid end to end!

Plants take the energy they need to grow from the air and from sunlight, but fungi are more like animals, and need to find energy sources from the natural world around them. For example, fungi can gather energy from sugar.

There are millions of different species of fungi in the world, and they can be divided into 3 groups:

- 1 **Mushrooms**
- 2 **Mould**
- 3 **Yeast**

Role of Fungi

Fungi can be used in different ways and have some very important jobs.

1. Food:

Some fungi can be eaten, such as mushrooms and truffles. And yeast can be used to bake bread, make pizza, and to make alcohol such as beer.

2. Medicine:

Some fungi can be used to make medicine. Fungi make antibiotics such as penicillin. These antibiotics are used to treat infections caused by tiny microbes called bacteria.

3. Disease:

A small number of fungi can cause disease in humans, plants and animals.

4. Decomposition:

Fungi have a very important job to do in keeping life moving on our planet. Fungi grow on forest floors and help to 'break down' decaying rubbish left by other plants and animals. This releases important elements within the soil that are essential for other living things to live. So, fungi are great recyclers, and some fungi has been used to clean up oil spills in the sea.



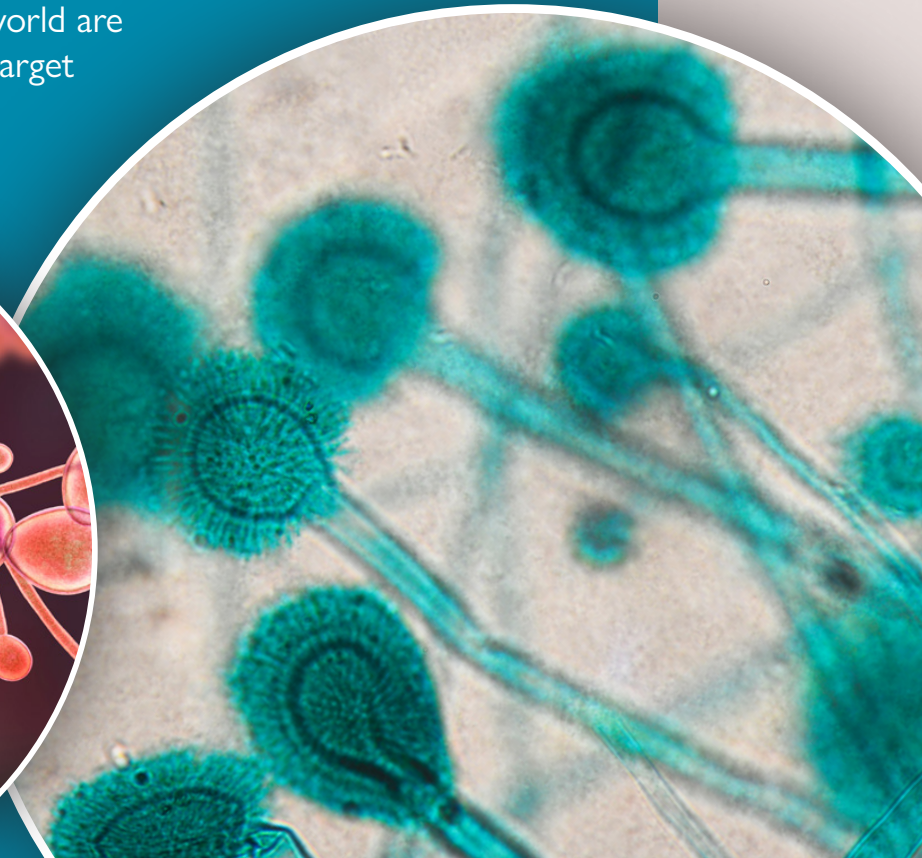
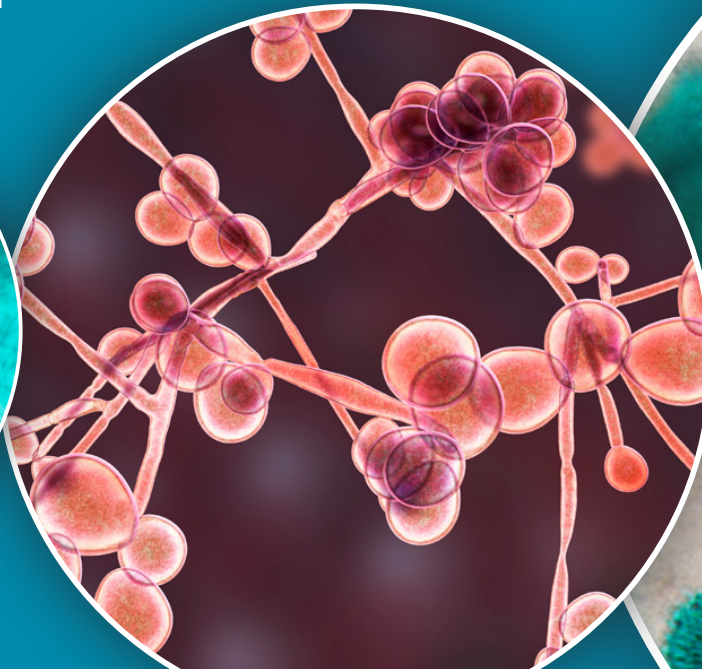
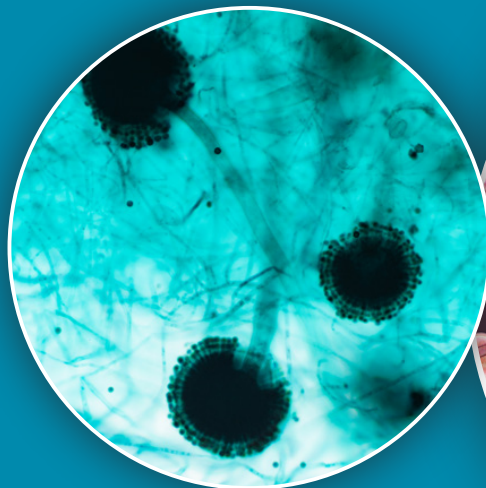
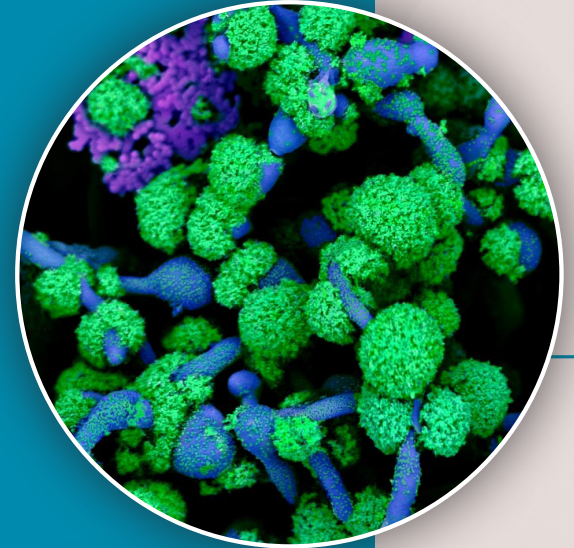
Who is interested in fungi?

Although most fungi do not cause any harm, and in fact, are very useful for humans, some fungi can cause disease.

Medical Mycology is the study of infections in humans and animals caused by pathogenic fungi.

Some diseases caused by fungi that you may have heard of include athlete's foot! In people who are immunocompromised fungi can cause much more serious diseases – especially when they enter the bloodstream of these people.

Fungal diseases can be treated using antifungals. Antifungals are like antibiotics but target fungal infections rather than bacterial ones. Sometimes these antifungal drugs do not work very well so scientists all over the world are trying to find better drugs to target fungal disease.





Scientists who study human diseases caused by fungi are called medical mycologists

Fungi are more similar to animals than they are to plants



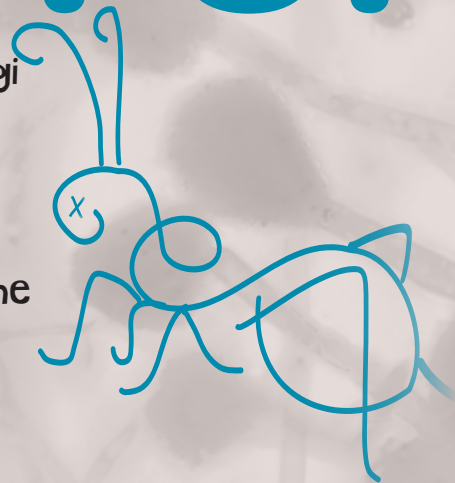
Scientists who study fungi are called mycologists



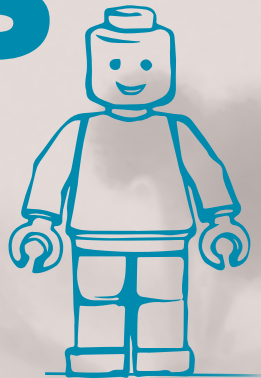
Some fungi can glow in the dark

FUNgi facts

One type of fungi can create zombie ants! When this fungi infects carpenter ants it can control their brains. By hijacking the brain the fungus can control where the ant goes.

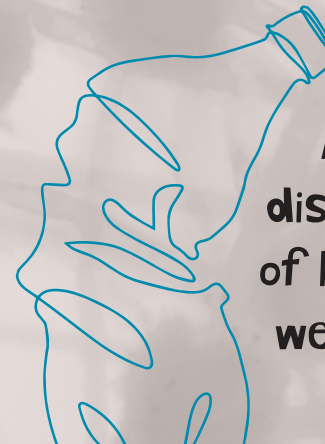


Lego is made using itaconic acid which is derived from fungi!



Fungi are not classified as an animal, a plant or bacteria. Fungi are eukaryotic. This means fungi have complex cells. Animals and plants are also eukaryotic.

A fungus has even been discovered that is capable of breaking down plastic in weeks rather than years!

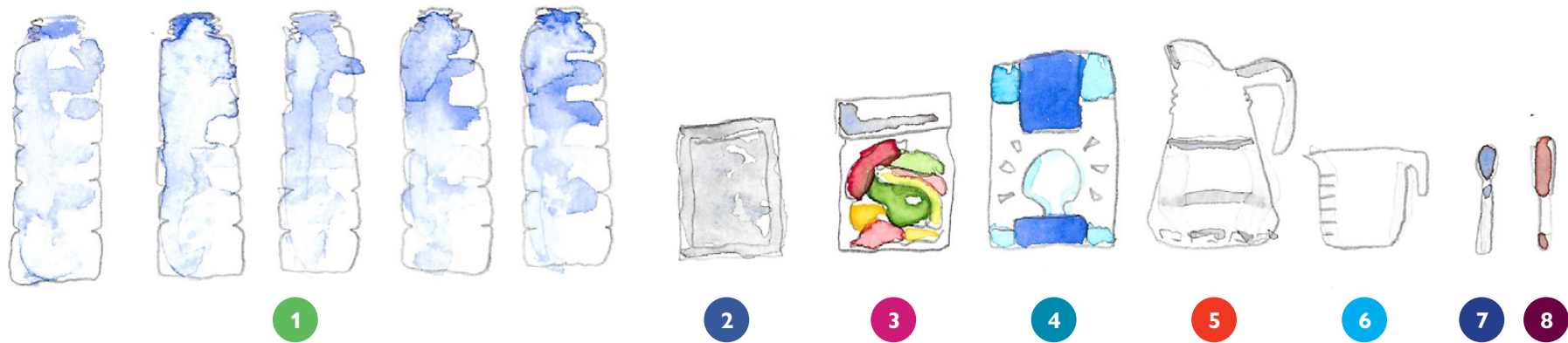




Experiments

In the following experiments we will learn more about fungi.

We will learn what fungi need to live, how they reproduce, and how to grow fungi in your kitchen!



1. Yeast Balloons

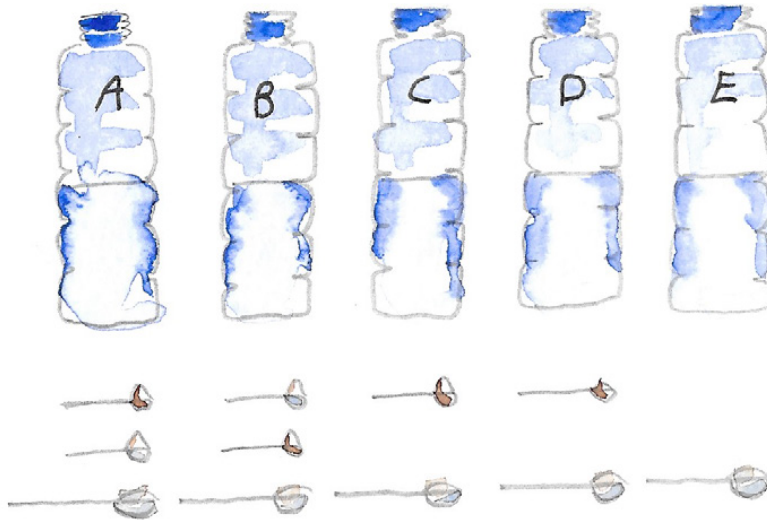
Yeast is a single celled fungus. For hundreds of years yeasts have been used to make food such as bread, pizza dough and beer! But how is yeast used to make food?

Yeast are living things, and just like humans, need energy to live. Yeast make energy using sugar in a process called fermentation. This process also makes ethanol and carbon dioxide (CO_2) as by-products. CO_2 is a gas and this is what makes bread rise and drinks fizz!

In this experiment, we show what happens when yeast has sugar and prove that yeast is indeed a living thing.

What you need:

- 1 5 empty plastic bottles (500ml is ideal)
- 2 Yeast (this can be found in the baking section in shops)
- 3 A packet of balloons
- 4 Sugar (any kind)
- 5 Warm water
- 6 Measuring jug
- 7 Teaspoon
- 8 Marker pen



Method:

- 1 Label the bottles **A**, **B**, **C**, **D** and **E**
- 2 Using a measuring jug add 200ml of warm water into each bottle
- 3 Place the following amount of sugar in the bottles:

Bottle A 2 teaspoons of sugar

Bottle B 2 teaspoons of sugar

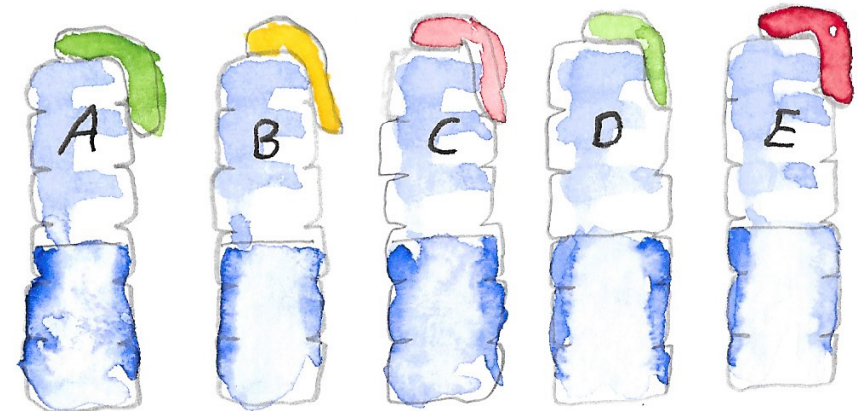
Bottle C 1 teaspoon of sugar

Bottle D ½ teaspoon of sugar

Bottle E 0 teaspoons of sugar

- 1 Put a cap on the bottles and shake them so the sugar dissolves.
- 2 Add 1 tablespoon of yeast to each bottle EXCEPT bottle **A**. (Bottle A is your negative control)
- 3 Give the bottles a gentle 'swirl'.
- 4 Stretch a balloon over each bottle opening – make sure this seal is tight.
- 5 Now wait 1 hour and observe what happens to the balloons (if you are using a sugar other than white sugar, wait for longer – until the bottle is warm to the touch).

Use the space at the back of this booklet to make a record of your findings. You could add a photograph, or write a short summary of what you found out.



Ask yourself!

- 1 Did the balloon on bottle E blow up? Why not?
- 2 Which balloon blew up the most? Did this bottle have more or less sugar than the others?
- 3 Why did the balloon on bottle A not blow up?

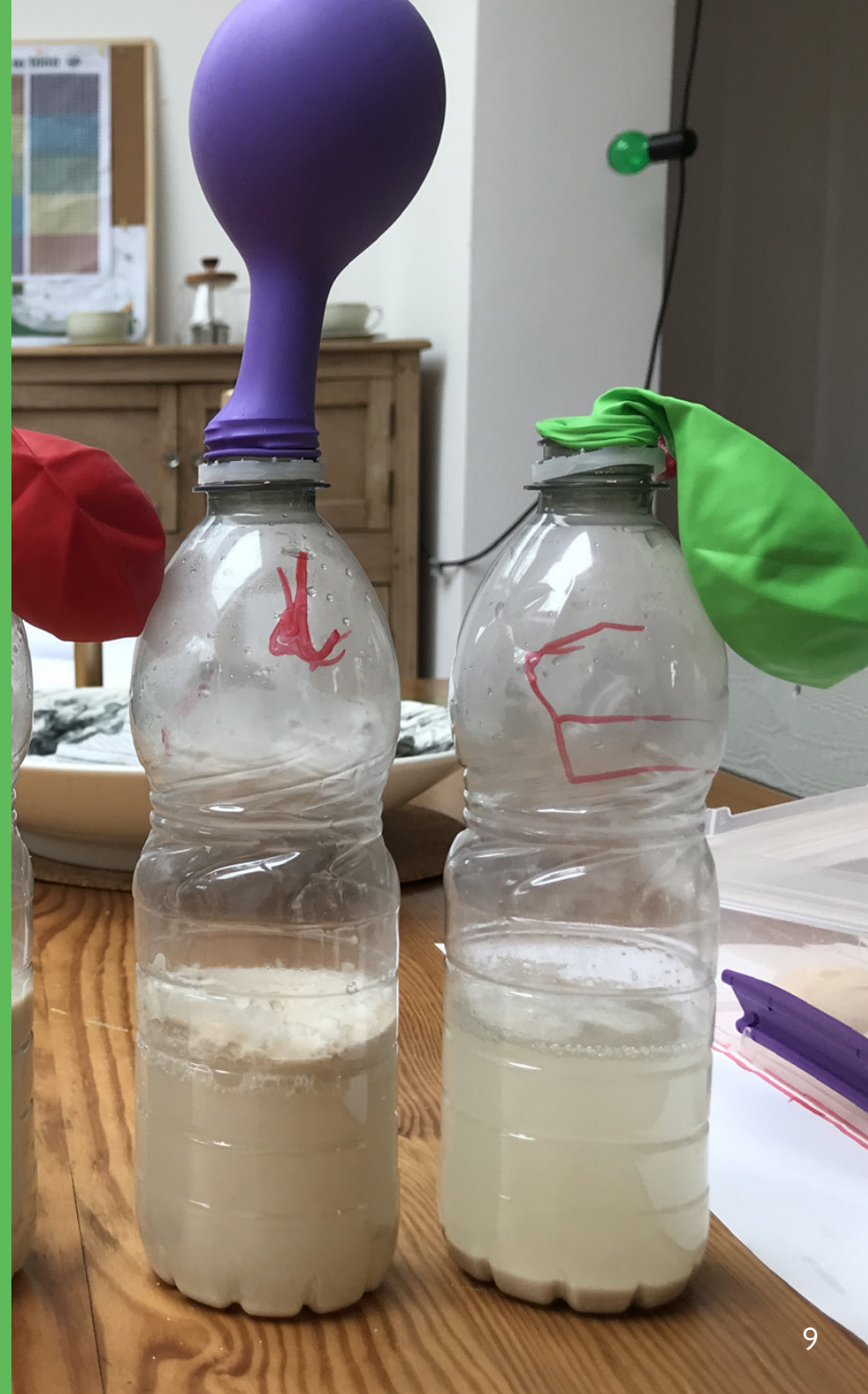
How did this happen?

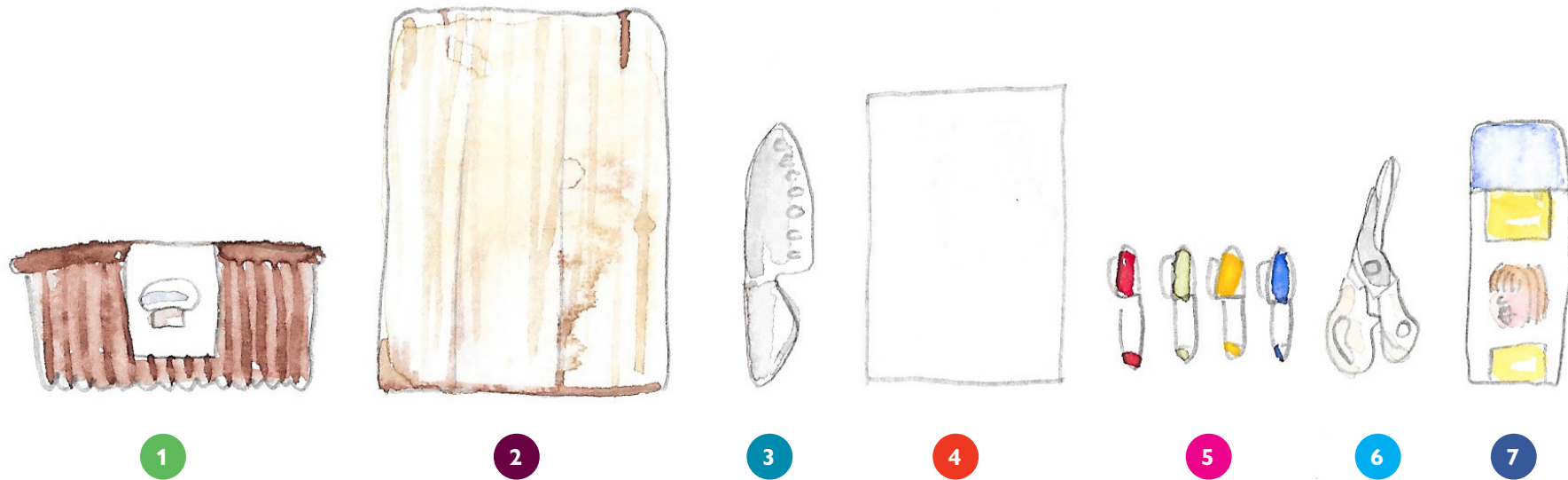
Yeast (a fungus) needs a supply of energy to live and grow. Sugar supplies this energy.

When yeast use sugar to make energy, it also produces a gas known as CO_2 . The CO_2 made by the yeast blew up the balloon. This is how yeast makes bread rise.

Other ideas

- 1 Why not use other types of sugar such as honey, golden syrup and brown sugar. What difference does this make to the balloons? *Note – if you use different types of sugar you may need to wait for more than one hour to see results.*
- 2 What happens if you place the bottles in the fridge? Do the balloons blow up more or less?





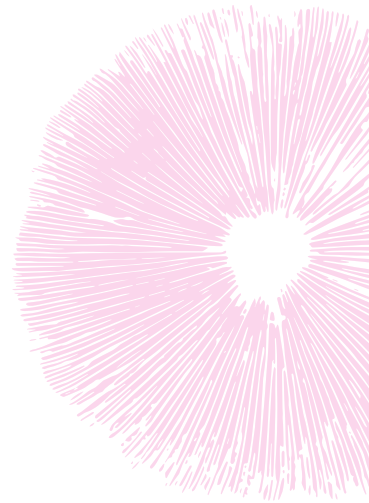
2. Spore prints/Mushroom Monkeys

A mushroom is an example of a fungus. They are also a living thing. Just like other living things, mushrooms can reproduce, or make more of themselves. They do this by making something called 'spores'.

Each spore is a single cell capable of developing into a new mushroom. A single mushroom can produce millions if not billions of spores. The spores look like a very fine dust. Spores are carried by wind to new locations where, if they land in the right place, they will grow into new mushrooms.

What you need:

- 1 Mushrooms
- 2 Chopping board and knife
- 3 Sheet of paper
- 4 A lunch box
- 5 Markers
- 6 Scissors
- 7 Hairspray (optional)



Method:

- 1 Remove the mushroom stalk and peel to expose the gills
- 2 Put the mushroom caps onto a piece of white paper, gill-side down
- 3 Add a drop of water to the top of each mushroom cap
- 4 Cover the mushroom caps with a lunch box (or any other suitable box) and leave overnight
- 5 Remove the mushroom caps to reveal a spore print
- 6 Spray the paper and the spore prints with hairspray (if you have it). This will prevent smudging
- 7 Draw on a monkey or a lion face!

* Wild mushrooms should not be handled or eaten unless they have been examined by a mushroom expert and determined to be edible.

Use the space at the back of this booklet to make a record of your findings. You could add a photograph, or write a short summary of what you found out.

How did this happen?

The mushroom released spores from its gills which were collected on the paper.

Other ideas?

- 1 What happens when you use different types of mushrooms*? Are the prints different?



3. Growing mould

Sometimes green or black fluff appears on a slice of bread which we quickly throw away – but did you know this mould is actually a living thing. Mould is a type of fungus and 1000s of different types exist. Mould grows from spores which float around in the air and if these spores land on a surface with the right conditions, mould will form.

Although mould often looks quite gross when it grows on food, it has many uses. Mould can be used to make cheese, soy sauce and the antibiotic penicillin.

In this experiment we will grow our own mould and see what conditions are necessary for it to grow.

What you need:

- 6 Sandwich bags
- 6 Stale slices of bread (not yet mouldy!)
- Water
- Sugar
- Lemon juice



Method:

- 1 Label your plastic bag with the following:
 - A. Fridge
 - B. Freezer
 - C. Sugar
 - D. Lemon Juice
 - E. Water only
 - F. Control
- 2 Put a few drops of water on each 5 of the slices of bread. Place the dry slice of bread into the bag labelled **Control** and seal.
- 3 Place 1 slice of bread into each of the other bags. Seal bag **A** and **B**.
- 4 Into bag **C** add a tablespoon of sugar and shake. Seal.
- 5 Into bag **D** add some lemon juice and shake. Seal.
- 6 Place bag **A** in the fridge and bag **B** in the freezer. Place all other bags in a room temperature environment.
- 7 Observe the bags every 24 hrs for 3 days and watch the mould grow.

Caution: *there is no need to reopen the bags once the mould has grown. Please discard in a bin!*

Use the space at the back of this booklet to make a record of your findings. You could add a photograph, or write a short summary of what you found out.

In which bag did the mould grow fastest? Did any mould grow in the freezer? What do you think is the best way to store bread to reduce mould growth? What colour was the mould? Do you think all the mould was the same?

How did this happen?

The fuzzy stuff growing on your bread is mould, which is a type of fungus. Unlike plants, moulds don't grow from seeds – they grow from spores. Spores are so tiny that they can't be seen by the naked eye. They float around in the air all around us looking for somewhere to grow. When these spores land on the bread they can use it as their food. The spore begins to grow to form a mould which is visible by eye. Moulds grow better in damp conditions which is why the mould shouldn't grow as fast on your 'control' slice of bread.

There are thousands of different moulds in the world and different moulds can grow on different foods. These can be all different colours too – a mould which grows on lemons may look blue-green, a mould on strawberries can look white, while bread mould often looks white at first before turning black.

Often mould will grow more easily on fresh fruit and bread at room temperature. There are a few reasons for this.

- 1 These foods do not contain a lot of preservatives. A preservative is added to foods to make them last longer and can prevent mould from growing. Lemon can be considered a natural preservative.

- 2 Moulds prefer nice warm temperatures. On warm summer days food can become mouldy much faster! Moulds hate the freezer and can't grow at that temperature at all. They also don't really like the temperature of the fridge and take a much longer time to grow there.

Other ideas

Did you know mould spores are **everywhere** - including on your hands! Why use bread to see how clean your hands are?

- 1 Place one slice of bread in a bag without touching it with your hands. Using a pair of kitchen tongs could work or else wear gloves. Seal the bag
- 2 Touch a slice of bread with unwashed hands, then place in a bag and seal.
- 3 Now wash your hands, then touch the bread before placing in a bag and sealing.
- 4 Place these bags of bread in a room temperature environment and observe for 3-5 days

On which slice of bread did most mould grow? Do you think spores live on your hands? Does washing your hands reduce the amount of spores present on your hands?



Glossary

Organism:

An organism is any living thing. Organisms include humans, animals, bacteria, fungi and plants.

Eukaryotic:

A eukaryotic organism is one that has a clearly defined nucleus in their cell. The nucleus is the part of the cell which contains DNA.

Species:

This is a group of similar organisms which can reproduce. It is a way of dividing organism into groups.

Pathogenic:

An organism is pathogenic if it can cause disease.

Immunocompromised:

An immunocompromised person is someone with low immune system defences. This means they cannot fight off infections and diseases as well as other individuals. Some people can be permanently immunocompromised while for others it is only temporary.

Antifungals:

this is a drug which can kill fungi or stop them growing.

Control:

A control is used in an experiment to compare your experiment results. A control is constant and unchanged throughout the course of the experiment.

Microbes:

Microbes are tiny living things that are found all around us and are too small to be seen by the naked eye. They live in water, soil, and in the air. The human body is home to millions of these microbes too, also called microorganisms. Some microbes make us unwell, and others are important for our health

Findings

Use the space at the back of this booklet to make a record of your findings. You could add a photograph, or write a short summary of what you found out.



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Spore animal face drawings (page 11) credit: gosiencekids.com

