Welcome to the World of Fungi

In the beginning

'Can you believe that fungi have been around on earth longer than humans?'

- ► Earth is approximately 4.6 billion years old.
- ► Humans have been on earth for about 200,000 years.
- ► Fungi have been on earth for about 500 million years.

Fungi are so tough and well adapted to their environment that they outlived the dinosaurs. The scientists that study fungi (mycologists) have so far identified more than 100,000 species, but estimate that there could be 1.5 million species all over the world.

►Question: Why do you think not all species have been found?

There are so many living organisms on earth that scientists have classified them into 5 kingdoms:

1. Animals
2. Plants
3. Bacteria
4. Protists
5. **Fungi**

[Note: all those names are plural. If you have one mushroom, it is a fungus; if you have two they are fungi.]

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Let's focus on fungi

What do you think of when you read the word.....**fungi?**

.....mushrooms and toadstools?

These answers are correct, but they aren't the only answers.

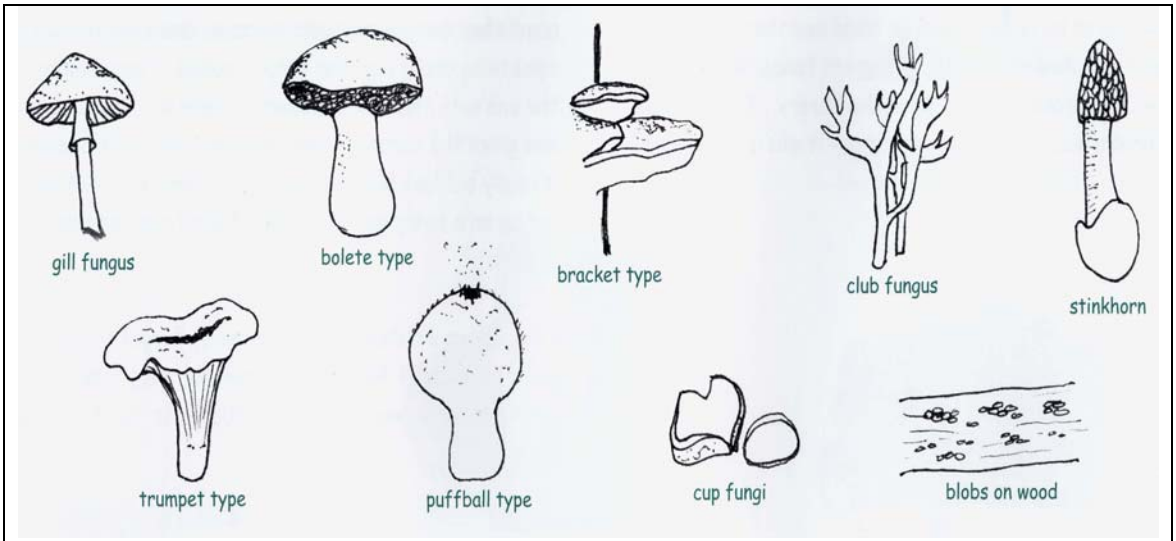
Bacteria are called **prokaryotes** whilst fungi are **eukaryotes** and may be single celled (yeast) or filamentous and multicellular (with 100s or 1000s of cells.)

Filamentous multicellular fungi include:

mushrooms and toadstools
moulds
cup fungi
bracket fungi
…and lots of others

They all have different:

sizes
shapes
colours
smells
textures



From *Fungus Fred Goes Foraying* by Margaret Hadley

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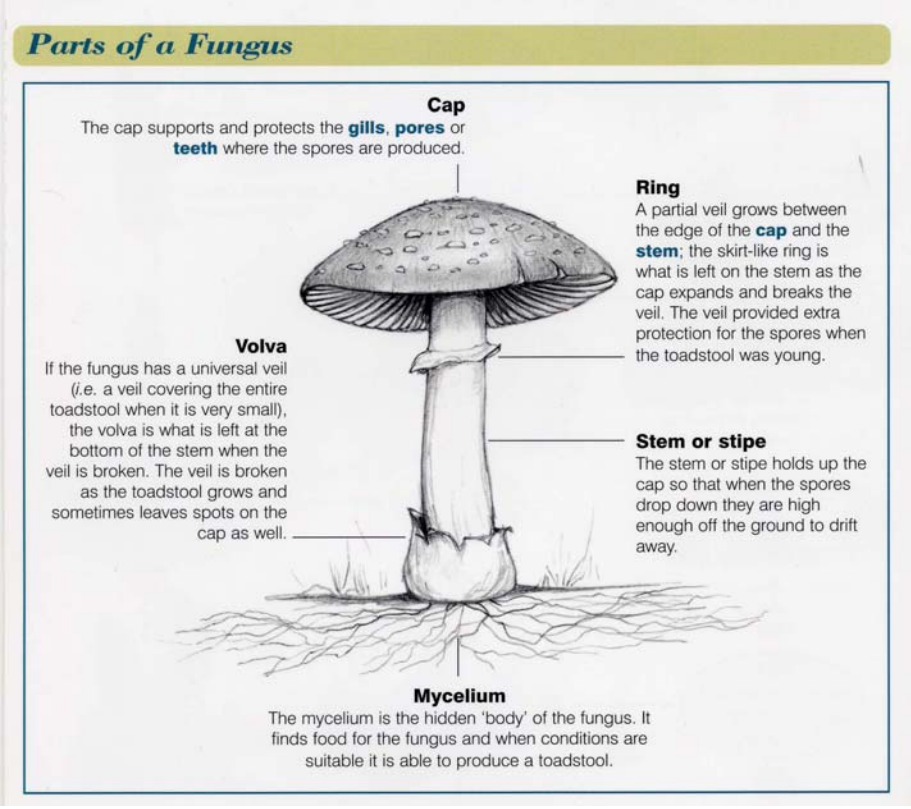
What are Fungi Made of?

If you pull a shop-bought mushroom apart with your fingers you'll see that the body of the mushroom is made up of a network of threads or fibres – these are called **hyphae.** A **hypha** is characteristic of fungi. It is a long, growing tube.

Draw and label diagrams of an animal cell and a hypha in this box.

Animal Cell **Hypha**

The large network of hyphae is called the **mycelium**. It is responsible for finding food sources for the fungus.



From *The Fungi Name Trail* by Liz Holden & Kath Hamper

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Growth of a mushroom occurs in different stages. The mycelium grows under the soil, searching for food.

This searching and branching outwards develops the mycelial network. Only when conditions are correct, does the mycelia grow upwards out of the soil to produce a **mycelial knot** that eventually grows into the visible mushroom.

►**Experiment: How the Mushroom got its Spots.** Try the experiment in the booklet for yourself to learn a bit more about mushroom growth.

Fungi can be:
1. Single celled
OR
2. Septate
OR
3. Aseptate

Use this box to draw and label diagrams of a single celled fungus (yeast), a septate fungal hypha, and an aseptate fungal hypha.

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Why aren't Fungi Plants?

Draw and label diagrams of a plant cell and a hypha in this box. Label them to remind yourself how they compare with one another.

Plant Cell	Fungal hypha
Cellulose cell wall Chloroplasts	Cell wall made of **chitin** No chloroplasts

KEY DIFFERENCE: Feeding.

- Plants make their own food, converting light energy gained from the sun into chemical energy, using their chloroplasts. This is called photosynthesis.
- Animals engulf their food (even individual animal cells do this).
- Fungi secrete enzymes into their food to digest it externally; they then absorb the small molecules produced by the digestion as their nutrients.

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Fungi differ in the way they feed. They can be:

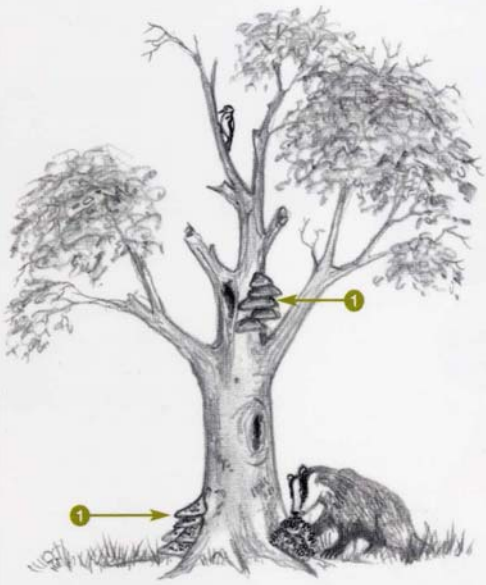
1. **Saprotrophic** (obtaining their nutrients by decomposing [and therefore recycling] dead organic materials)
2. **Symbiotic** (in a close, mutually-beneficial relationship with another organism)
3. **Parasitic** (living on or in another organism (the 'host') and taking their nutrients from the host; this may injure and may kill the host).

How do fungi feed?

Unlike plants, fungi cannot gain their energy directly from the sun by photosynthesis; they have had to develop other ways to get it.

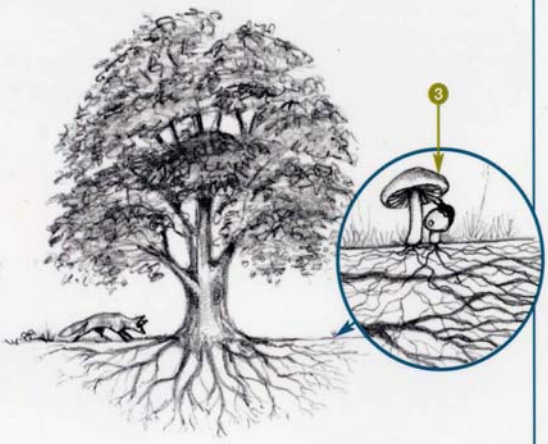
The majority of the fungi are, however, either saprotrophic (**decomposer**) fungi or **symbiotic** fungi.

Decomposer fungi are busy helping to break down dead wood 2 and other plant and animal material. The fungi absorb some of the nutrients but most goes back into the woodland ecosystem so that it can be recycled.



A few of the fungi do this by feeding off living trees or plants 1, sometimes killing them. These fungi are **parasites** but it is important to remember that they have a vital role in the natural woodland, as they remove old or weak trees and create a dead wood habitat that insects and other animals can use.

If you look carefully at the pictures you will find lots of animals. Try and work out some of the food chains here, starting with the energy flow from the sun and ending with a top predator – make sure you include a fungus along the way!



Symbiotic fungi actually establish a physical link with another organism (plant, tree or alga) 3 so that both can benefit by the arrangement. For example, the mycelia of some fungi grow around and sometimes into the roots of trees to enable the exchanges to take place. Over 80% of higher plants and trees gain additional mineral salts in this way, particularly useful where the soil is poor. In return the tree or plant sends some of its own surplus energy (carbohydrates) down into the fungus!

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Hyphal growth is characteristic of fungi

Hyphae grow at their **tips**; they search for areas in the soil which contain plenty of food. They don't engulf their food like animals, so **how does the food enter the hyphae?**

The answer is **enzymes digest the food outside the hyphae**. Special enzymes are released (secreted) from the hyphal tips and can break down large complex food into smaller soluble food that the hyphae can then absorb.

Where are Fungi Found?

Fields Forest floor On trees Back garden	Obvious?
On ships Window frames Cheese and bread (food) Between your toes In your mouth On your skin	Not so obvious?

►Question: How many uses for fungi can you think of?

SAFETY

Some fungi are edible, but some are POISONOUS

If you find a fungus growing wild

DON'T EAT IT

DON'T TOUCH IT

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Find the correct explanation to complete the statement.

Draw a line linking the start of the sentence in the left-hand column with the end of the sentence in the right-hand column.

1. Fungi are…	**…special enzymes that break down complex food into smaller soluble food.**
2. Fungal parasites...	**…500 million years ago.**
3. Fungal decomposers...	**…feed off living trees and plants and can sometimes kill them.**
4. Fungal symbionts…	**…break down dead wood, plant and animal material.**
5. Fungi can be found...	**…eukaryotes.**
6. Fungi feed via...	**…make physical links with another organism. Both benefit from the relationship.**
7. Fungi first appeared on earth...	**…(a) in woodland areas, (b) between our toes, (c) on ships.**

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