EASY SCIENCE

A fruiting body of the Amanita group of fungi. See the easily recognisable coloured cap, pure white stem, veil and gills.

Photograph: Bernard Slippers, FABI

HAVE FUN WITH FUNGI

Fungi are so fascinating that we wanted to share some fun facts about fungi with you. Fungi (the plural of fungus) both cure and cause disease. They determine what plants grow in your yard and in forests, and keep us from being buried in waste. Some fungi taste great – others taste and smell terrible. Some can kill you and others can heal you.

Mushrooms, toadstools, mildews and moulds are all fungi. Since some are poisonous, be sure to wash your hands after touching them, and never eat any that you have picked yourself.

WHERE DO THEY LIVE AND GROW?

Fungi can be found in many different environments. They will grow on almost anything. Fungi can be found outside in forests, gardens and even in your own backyard. They can also grow on our feet causing them to become itchy, known as athlete's foot. Many species are often found on foods in the form of yeasts and moulds.

Although fungi look a bit like plants, they cannot make their own food like plants do. Some fungi feed on dead things, like the remains of plants and animals. They are called saprophytes. Others feed on living things. They are called parasites and can cause disease. Ringworm in humans and mildew in plants are caused by parasitic fungi.

All fungi are made up of fine threads called ***hyphae*** (pronounced hi-fee). It is easy to see the hyphae in moulds, but in mushrooms and toadstools hyphae are packed more tightly together.

Fungi reproduce by forming spores. These are tiny cells that get scattered by the wind and rain. When they land in the right place they grow into more fungi.

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EasyScience is produced by the South African Agency for Science and Technology Advancement (SAASTA), an operational unit of the National Research Foundation. SAASTA's mission is to promote the public understanding, appreciation and engagement with science and technology among all South Africans.
Visit the website: www.saasta.ac.za for more information.

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Fungi growing in elephant dung in the Kruger National Park. Photo: Franz Rabe – Natural Photography – www.naturalphoto.co.za

MAKE A SPORE PRINT

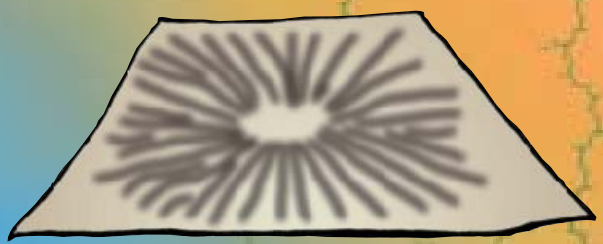
Mushrooms and toadstools are the reproductive (fruiting) bodies of fungi. These fruiting bodies produce masses of tiny specks, called spores. The spores fall from the mushroom or toadstool and develop into new fungi. Each fruiting body has its own spore pattern. You can see the pattern by making a spore print.

You will need:

- Sheets of white paper
- A jam jar
- A mushroom or toadstool (Make VERY sure to wash your hands carefully after you have handled a mushroom or toadstool you have picked yourself.)

Pull the top of the mushroom or toadstool from the stalk, but take care not to damage the delicate gills beneath the cap. The spores are borne on these gills.

Place the cap, gills downward, on a piece of clean, white paper. Place a jam jar over the cap to prevent it from drying up or being disturbed. After a few days, carefully remove the cap from the paper. You should see a pattern on the paper where the spores have fallen.



YOU CAN PROVE THAT SPORES ARE IN THE AIR

In the air, there are millions of tiny particles called spores which, if they fall onto suitable ground, will grow into fungi. The spores are so small, however, that you cannot see them with the naked eye. You can easily prove that they exist by giving them something on which to grow.

You will need:

- A drinking glass
- A saucer
- A magnifying glass
- A piece of stale bread

Place a small piece of stale bread on a clean, dry saucer and moisten it with a few drops of water. Now place the drinking glass over the saucer. This is called a moist chamber.

After a few days the surface of the bread will be covered in darkish patches. These are the start of growths of fungi, called fungal colonies. They have grown from spores that settle on the bread out of the air. They may be bluish in colour, in which case the fungus is probably ***Penicillium***; or they may be blackish, in which case they are probably ***Rhizopus*** or ***Aspergillus***. If they are white, it is ***Mucor***. You will have to decide how to record your results. Do you identify each species of mould by its scientific name, or do you just describe them (fluffy red colonies, white fuzzy spots, blue-green velvet, etc.)

The colonies will continue to grow until all the goodness has been taken from the bread.

Look at the fungi with your magnifying glass. Can you see the hyphae strands, or the round spore cases?

Make more food fuzzies

Repeat the activity with orange peel and cheddar cheese and see what fungi you get. Do the fuzzy colours on the cheese, bread and orange peel differ from each other? Draw what you see through your magnifying glass in your note book.

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GROW YOUR OWN YEAST FUNGUS

The yeasts are one very important and beneficial group of fungi. Common yeast used in baking bread grows so fast, you can complete an experiment in two days! In the following experiment you are going to measure the amount of carbon dioxide (CO_2) released during the growth of yeast. The growth of the yeast (it is alive, made of living cells!) stops when one of the nutrients required by the yeast is gone, or when the liquid gets too acid (low pH) and kills the yeast.

You will need:

- A teaspoon measure
- A permanent marker
- Active dry yeast
  (used in baking bread – do not use quick-rising varieties)
- Bottled cold-drink and tap water in equal amounts. Shake the cold-drink bottle and let the foam settle before opening, or open and allow the cold-drink to go flat overnight.
- Identical round, thin latex balloons –"water balloons" are slow to expand. "Helium-quality" balloons give good results. Blow up the balloons a few times and let the air out.

Label each bottle with a number to keep track of what each one contains – control (water), treatment and contents – so that you can tell bottles containing the same solution (replicates) apart. Colour is not a reliable means of identification.

Put a teaspoon of dried yeast in each bottle. Seal the bottles tightly and shake the bottle. Remove the lids and stretch a balloon over the mouth of each bottle. The balloon should fit very tightly so that the carbon dioxide does not leak into the air. Use a rubber band to keep the balloon in place.

Place each container in a warm area out of direct sunlight (on top of a refrigerator or clothes dryer) where they will not be disturbed.

- When you add the warmth, the yeast starts feeding on the sugar. As it feeds, it breathes. Yeast breathes out carbon dioxide which fills the balloon.
- You have now captured yeast breath!

Record the diameters of the balloons and the time you start the experiment for each bottle. One good method of measurement is to wrap a string around each balloon at its widest point, and then measure the length of the wrapped string against a ruler. Record all other things you see happen. Did the colour change? Did one balloon have a hole in it?

Calculate the average diameter of the balloons in each treatment (cold-drink) and the controls (tap water). The average is calculated by adding all the diameters of all the balloons in a treatment then dividing by the number of balloons in the treatment.

Compare the results (average balloon diameters) of the experiment. A graph of the averages might help show your results.

QUESTIONS TO HELP DESIGN EXPO EXPERIMENTS

- Is the average of the treatments larger than the average of the controls?
- Is the average of one treatment larger than the averages of the other treatments?
- Is carbonated water a better control than non-carbonated water in experiments with, for instance, sugar water?
- Is the amount of sugar used in a bottle related to the amount of carbon dioxide released into the balloon? Hint: graph sugar

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THE FUNGI KINGDOM

There are over a million kinds of animals and nearly half a million kinds of plants, so it is essential to have some way of classifying them or arranging them into groups so that we can refer to them easily. I am sure you have heard of the animal kingdom and the plant kingdom before.

Fungi are placed in a separate kingdom because they are different from plants and animals. They live almost anywhere in the soil, water, and air. Fungi have similar characteristics to plants and are sometimes mistakenly put in the plant kingdom, but they do not produce their own food like plants since they have no chlorophyll. Fungi take nutrients from the animals, plants, or decaying matter on which they live. They reproduce by spores sexually or asexually.

JOBS IN FUNGI RESEARCH

Mycology is the study of fungi. A fungi researcher is called a mycologist. Someone who studies the diseases fungi cause in plants is a plant pathologist. Fungi are important in the food and biotechnology industry, medical and veterinary sciences, plant pathology and ecology directions, and in studying the DNA of organisms.

A few examples of what mycologists do: discover, describe, illustrate, name and classify new fungi; decipher the important role fungi play in nature; study the fungi that make humans, animals and plants sick, and how they do it; discover fungi that can be used to make all kinds of useful chemicals or medicines; study the DNA of fungi; lecture at universities, schools and to the public.

SCHOOL SUBJECTS TO TAKE:

Maths and physical science (with at least a D symbol for both subjects in the higher grade) are compulsory, and biology is a recommended subject choice. A Senior Certificate with matric exemption is required for studies at a university and a Senior Certificate for studies at a technical university.

FURTHER TRAINING:

UNIVERSITY: The minimum requirement is a BSc degree with botany, or preferably microbiology or plant pathology, as a major. An honours science degree in microbiology, plant pathology or genetics (4 years) is recommended. A masters and PhD degree in microbiology, genetics or plant pathology are further study and research options.

TECHNICAL UNIVERSITY: Recommended courses are NDip Forestry, NDip Horticulture and the NDip Nature Conservation. With this training one is not able to work as a professional mygologist, but will work with professional botanists and mycologists in a large number of the careers.

WHERE CAN I WORK?

Employment possibilities for mycologists exist at the government research institutes, the CSIR, universities and private organisations such as the pharmaceutical, biotechnology and mushroom industries, and at breweries. You can also create work for yourself.