



Key Stage 2

Teacher Guidance – Introduction to Microbes

Micro-organisms, more commonly known as ‘germs’, ‘bugs’ or ‘microbes’, are tiny living things too small to be seen with the naked eye. They are found almost everywhere on Earth. It is important to clarify that microbes are not innately ‘useful’ or ‘harmful’. Rather that some microbes can be useful to humans whilst others can be harmful depending on the situation. For example, the mould *Aspergillus* is used to help make chocolate, however can cause harm to humans if inhaled into the lungs. Although extremely small, microbes come in many different shapes and sizes. The three groups of microbes covered in this resource are viruses, bacteria and fungi.

Viruses are the smallest of the three and often cause illnesses like coughs and colds. They need a ‘host’ cell in order to survive and reproduce. Once inside the host cell, they rapidly multiply and destroy the cell in the process. One type of virus is Rhinovirus, also known as the common cold virus. There are over 25 different species that can cause the common cold.

Bacteria are single-celled organisms that are smaller than fungi but larger than viruses. They can be divided into three main groups by their shapes – cocci (balls), bacilli (rods) and spirals. Cocci can also be broken down into three shapes - clusters, chains or groups of two. These shapes can be used to help identify the type of infection a patient has. If a single bacterial cell was scaled up 5,000 times it would be the size of a garden pea.

Fungi are the largest of the three microbes and are multi-cellular organisms (made up of more than one cell). Some fungi are useful, and some can be harmful to humans. For example, *Saccharomyces* is a yeast that is used to help bread rise. Fungi obtain their food by either decomposing dead organic matter or by living as parasites on a host. Fungi secrete secondary products while feeding that cause swelling and itching, such as athlete’s foot.

Most microbes are not harmful, and it is important to remind students of this. Some microbes are only harmful to humans when taken out of their normal environment. *Escherichia coli* (E. coli) is commonly found in our gut and is harmless, but if it is transmitted to the urinary tract it can cause bladder and kidney infections.

Useful microbes

One of the main ways in which microbes are beneficial is in the food industry. Cheese, bread, yoghurt, chocolate, vinegar and alcohol are all produced through the growth of microbes. The microbes used to make these products cause a chemical change known as fermentation – a process by which the microbes break down the complex sugars into simple compounds like carbon dioxide and alcohol. Fermentation changes the product from one food to another.

When the bacteria *Streptococcus thermophilus* or *Lactobacillus bulgaricus* are added to milk they consume the sugars during growth, turning the milk into yoghurt. So much acid is produced in fermented milk products that few potentially harmful microbes can survive there.

Lactobacillus are generally referred to as a good or ‘friendly’ bacteria. The friendly bacteria that help us digest food have been termed probiotic bacteria, literally meaning ‘for life’. It is these bacteria that we find in yoghurts and probiotic drinks.

Yeast, *Saccharomyces cerevisiae*, is used to make bread and dough products through fermentation. In order to multiply and grow, yeast needs the right environment, which includes moisture, food (in the form of sugar or starch) and a warm temperature (20° to 30°C is best). As the yeast ferments it gives off gasses which get trapped in the dough and the lump of dough expands.

Harmful Microbes

Some microbes can be harmful to humans and can cause disease: the *Influenza* virus causes the flu (short for Influenza – other respiratory tract infections are common cold or influenza-like illness), *Campylobacter* bacteria can cause food poisoning and the dermatophyte fungi, such as *Trichophyton*, can cause diseases such as athlete's foot and ringworm. Microbes like these are known as pathogens. Each microbe can make us ill in different ways.

When harmful bacteria reproduce in our bodies, they can produce harmful substances called toxins which can make us very unwell, fortunately this is rare. Once inside a cell, they multiply until fully grown and leave the host cell. Dermatophytes generally prefer to grow or colonise under the skin and the products they produce while feeding cause swelling and itching. Someone who is ill because of a harmful disease-causing microbe is said to be infected.

Many harmful microbes can pass from one person to another by a number of different routes – air, touch, water, food, aerosols (such as sneezes and water vapour), animals, etc. Diseases caused by such microbes are said to be infectious diseases. In many instances, our normal body flora (microbes) also help prevent harmful microbes growing by either colonising the area so that there is no room for the harmful microbes to grow or by altering the environment. For example, the normal flora in our gut keeps us healthy by preventing harmful bacteria like *Clostridioides difficile* from multiplying. When our normal body flora is compromised, *Clostridioides difficile* can multiply and cause diarrhoea and other problems in the gut.

SW2 Microbes Fill in the Blanks?

- Fermentation
- *Lactobacillus bulgaricus*
- Yoghurt
- Bread
- Cheese
- Air (CO₂)

SW1 Yeast Races Answers

Conclusions:

What caused the dough to rise up the container?

The yeast breaks down the complex sugars present in food (the flour) and produces gas and acids. These acids change the taste, smell, and form of the mixture, whereas the gas makes the dough rise.

What is this process called?

Fermentation

Why did the dough in container B move faster than container A?

The addition of sugar provides a readily available food source for the yeast to catalyse the process.