

# Food Hygiene & Safety

## Microbes in Food – Teacher Notes

### Background

These resources have been funded by the European Union's SafeConsume project, which is an EU-wide project to reduce illness caused by foodborne pathogens. Find out more information at <http://safeconsume.eu/>.

These resources have been developed following research with students and teachers from across Europe and have been tested with schools during development. Following research with consumers across Europe several food related risk behaviours have been identified which we seek to improve knowledge about.

This activity covers the four different microbes including bacteria, viruses, fungi and parasites, and how they might be implicated in food. Students will learn about both useful microbes and how they are used in the food industry, as well as harmful microbes and how they can lead to foodborne illness. The lesson also covers the top five foodborne pathogens in Europe: *Salmonella*, *Campylobacter*, *Toxoplasma*, *Norovirus*, and *Listeria monocytogenes*.

### National curriculum links:

KS3: RSHE; Health and prevention.

KS4: Food preparation and nutrition GCSE; Cooking and food preparation - The scientific principles underlying the preparation and cooking of food.

### Lesson learning outcomes:

- Foodborne illness is caused by microbes, of which there are four different types
- The difference between viruses, bacteria, parasites and fungi
- There are useful microbes in food
- The importance of handling food correctly to avoid foodborne illness

### Resources:

- The Microbes in Food PowerPoint
- Harmful microbes additional slides PowerPoint
- Microbe matching activity statements
- Student handout 1: Case Study: a cautionary tale
- Student handout 2: Case Study: a cautionary tale -answer sheet
- Extension activity: Research group task

### Lesson plan

Designed for 11-14 year olds, but could be adapted for 15 - 18 year olds.

1. Use the introductory slides to discuss foodborne illness, common symptoms, and how you may not be able to tell which food caused the illness.



2. Using the **Microbes in Food PowerPoint**, introduce the four types of microbes: bacteria, virus, fungi, protozoa / parasites and explain that most microbes are harmless or even beneficial for us, whilst others that can cause illness are called 'pathogens'.
3. Explain to students that they will be playing a matching activity to revise microbes with the **Microbe matching activity statements**
4. Give students the cut outs of bacteria, virus, fungi and parasite and ask them to match the statements for each. Go through the answers as a class or in pairs.
5. Use the **Harmful microbes additional slides** PowerPoint to explain the five common foodborne pathogens in Europe: *Salmonella*, *Campylobacter*, *Toxoplasma*, *Norovirus*, and *Listeria monocytogenes*. There are also additional optional slides on *Bacillus cereus*, and *E.coli*
6. Explain to students that some bacteria develop 'spores' that can survive harsh conditions and live without water or nutrients.
7. Use the 'examples of useful microbes' slides to discuss the useful and beneficial microbes that live naturally within us and foods that are made with or contain microbes. Some of these examples students will be familiar with, such as bread and cheese, whilst others may be new examples, for instance fermented foods.
8. Explain to students that they will be then be looking at a case study of how microbes can cause foodborne illness using the **Student handout 1: Case Study: a cautionary tale** on *Bacillus cereus*.
9. Encourage students to feedback their answers and thoughts to the class – answers can be found in the **Student handout 2: Case Study: a cautionary tale -answer sheet**
10. If time allows, use the Extension activity: Research group task to allow students to work on a poster or fact file on one of the top five pathogens. Alternatively, this activity could be given as homework, if there is a lack of time.



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### Case study: A cautionary tale: answer sheet

#### What happened

The date is 1<sup>st</sup> October 2008, the place is Brussels in Belgium. A 20 year old man became ill and died after eating leftovers, a spaghetti meal with tomato sauce that had been left unrefrigerated at room temperature for 5 days and reheated in the microwave before consumption.

The man experienced symptoms within 30 minutes including headache, abdominal pain, and nausea. He proceeded to vomit for several hours and experienced bouts of watery diarrhoea, consuming only water to rehydrate.

The man then later died in his sleep, his death occurred at approximately 4:00 AM, providing a timeline of 10 hours between consumption of the spaghetti meal and death.

#### The culprit: *Bacillus cereus*

*Bacillus cereus* is a type of bacteria that is able to form 'spores' that can survive heat and cooking. Spores are often activated during cooking and grow best at temperatures above 10°C. If kept at warm conditions for a length of time, the bacteria can produce a toxin that is able to survive high temperatures of cooking.

Foods that can commonly be contaminated with *B.cereus* include rice, spices, and cereals including pasta, and have also been associated with meat, vegetables, dairy, soups and sauces, as it originates from soil.

#### Questions:

1. Explain how the handling of leftovers in this case study led to the sudden death of a young person

When cooking and slowly cooling the meal, *B.cereus* spores in the pasta were given the right conditions to activate. Leaving the pasta at room temperature (above 10°C) for 5 days then allowed the bacteria to continue growing and eventually produce a toxin. When the food was reheated, the toxin was not affected and was in the food when it was eaten, this toxin killed the young person.

2. What can you do to prevent *B. cereus* infection?
  - Before cooking Wash fruit and vegetables to remove soil, which could contain harmful spores.
  - Put leftovers in the fridge or freezer within 2 hours of cooking to prevent the growth of bacteria. Leftovers should be reheated thoroughly to ensure bacteria in the food are killed.
  - Do not reheat rice or pasta more than once and only keep leftovers for a maximum of one day.



Cut these headings out and ask students to put each statement under the corresponding microbe. There should be 4 statements for each microbe

## Bacteria

## Fungi

## Parasite

## Virus

### Bacteria

Can be harmful (cause illness) and beneficial/useful (decomposition - “recycling” of organic materials)

Multiplies in humid environments with nutrients (e.g. sugar, fat, proteins), for example in food, drains, wounds

They spread directly between people or through food, water, soil and blood  
Most are killed by high temperatures and cooking  
Most are not killed by freezing, and cold temperatures can reduce growth

Examples: *Campylobacter* and *Salmonella* cause foodborne illness. Lactic acid bacteria are useful bacteria used to produce yoghurt, soy sauce and chorizo sausage



## Virus

The smallest type of microbe
Cannot grow or survive without a host (e.g. a human or animal)
They spread from person to person or from person to food through the air (e.g. sneezing), through vomit, faeces, or other bodily fluids (e.g. blood or saliva). Killed by cooking. They will not grow, but can survive in food.
Examples: Norovirus in oysters or soft fruits e.g strawberries.

## Fungi

The largest type of microbe. Can be harmful (cause illness) and beneficial/useful (decomposition - "recycling" of organic materials)
Multiplies in environments with nutrients, e.g. in food and humid building materials Mould is spread by spores and food can be contaminated from air. Food with visible growth of mould (e.g. leftovers, bread, jam) should not be eaten
Relatively tolerant to heat. Not killed by freezing. Cold temperatures can reduce their growth
Examples: Aspergillus flavus that produce aflatoxins in food (e.g. nuts). Saccharomyces cerevisiae (yeast) for baking and Penicillium camemberti for camembert and brie cheese

## Parasites

Different sizes. Can be harmful. Cannot grow without a host (e.g. a human or animal)
Can be spread between animals and humans through contaminated food, water, soil and blood
Killed by cooking and freezing. They will not grow but can survive in food
Examples: Toxoplasma can be found in meat and on vegetables, other parasites include intestinal worms (e.g. roundworm)

