



e-Bug



www.e-bug.eu



Key Stage 2 / Science  
Years 5 & 6



department for  
children, schools and families

<b>e-Bug Pack Content</b>	<b>SCIENCE</b>	<b>PSHE</b>
<b>1. Introduction to Microbes</b> <b>1.1 An Introduction</b>	<b>National Curriculum Link</b> Key Stage 2 Sc1: 2a, 2b, 2f, 2h Sc2: 5a, 5f	<b>National Curriculum Link</b> Key Stage 2 PSHE: 4f
<b>1. Micro-organisms</b> <b>1.2 Useful Microbes</b>	<b>National Curriculum Link</b> Key Stage 2 Sc1: 1a, 1b, 2a – 2d, 2g, 2j Sc2: 1a, 2b, 2g, 5f	<b>National Curriculum Link</b> Key Stage 2 PSHE: 2k
<b>1. Micro-organisms</b> <b>1.3 Harmful Microbes</b>	<b>National Curriculum Link</b> Key Stage 2 Sc1: 1a, 2a, 2b Sc2: 1a, 2g, 5f	<b>National Curriculum Link</b> Key Stage 2 PSHE: 2a, 2h, 2k 3b, 3d – 3e, 3g 4g 5d – 5e, 5h
<b>2. Spread of Infection</b> <b>2.1 Hand Hygiene</b>	<b>National Curriculum Link</b> Key Stage 2 Sc1: 1a, 1b, 2a – 2l Sc2: 2g, 5f	<b>National Curriculum Link</b> Key Stage 2 PSHE: 2a, 2h, 2k 3b, 3d – 3e, 3g 4g 5d – 5e, 5h
<b>2. Spread of Infection</b> <b>2.2 Respiratory Hygiene</b>	<b>National Curriculum Link</b> Key Stage 2 Sc1: 1a, 1b, 2a – 2l Sc2: 2g, 5f	<b>National Curriculum Link</b> Key Stage 2 PSHE: 2a, 2h, 2k 3b, 3d – 3e, 3g 4g 5d – 5e, 5h
<b>2. Spread of Infection</b> <b>2.3 Food Hygiene</b>	<b>National Curriculum Link</b> Key Stage 2 Sc1: 1a, 1b, 2a – 2l Sc2: 2g, 5f	<b>National Curriculum Link</b> Key Stage 2 PSHE: 2a, 2h, 2k 3b, 3d – 3e, 3g 4g 5d – 5e, 5h
<b>3. Prevention of Infection</b> <b>3.1 The Body's Natural Defences</b> <b>3.2 Vaccines</b>	<b>National Curriculum Link</b> Key Stage 2 Sc1: 1a, 2a, 2b. Sc2: 1a, 2g, 5f.	<b>National Curriculum Link</b> Key Stage 2 PSHE: 2a, 2h, 2k 3b, 3d – 3e, 3g 4g 5d – 5e, 5h
<b>4. Treatment of Infection</b> <b>4.1 Antibiotic Use and Medicine</b>	<b>National Curriculum Link</b> Key Stage 2 Sc1: 1a, 2a, 2b. Sc2: 1a, 2g, 5f.	<b>National Curriculum Link</b> Key Stage 2 PSHE: 2d 3b, 3d – 3e, 3g 4g 5d – 5e, 5h

Curriculum links are correct at time of printing, any changes to the national curriculum can be viewed on the e-Bug website [www.e-bug.eu](http://www.e-bug.eu)

# Welcome to e-Bug

e-Bug has been designed to bring the World of Microbes to life for children in the classroom environment. This resource is being distributed free of charge to teachers across the UK and other European countries, by both the Health Protection Agency and the Department of Health to improve student's knowledge of public health matters and to foster an interest in science. These tools may be copied for classroom use but may not be sold.

e-Bug is a European Commission funded exciting new initiative to create a curriculum supplement series (Key Stage 2 and Key Stage 3) that complies with the Department of Education and QCA educational standards for Junior and Senior schools. Its main aim is to teach young people about microbes, appropriate use of antibiotics, how microbial infections are spread and can be prevented through improved hygiene and vaccine use. The packs teach that antibiotics are a valuable resource that should not be misused. Over 19 European countries have been involved in the development of e-Bug and it has been evaluated in over 3000 children in England, France and the Czech Republic. The e-Bug pack is supported by a website from which all the pack resources, videos demonstrating the activities and additional activities can be downloaded. The website contains complimentary interactive games which teach the key messages while the child is having fun.

The pack consists of 9 topics divided into four main sections which can be used in sequence or as individual activities designed to fit into 45 minute classroom slots.

Each of these sections contain background information for teachers, detailed lesson plans, modifiable student worksheets and handouts as well as

- Creative inquiry based activities to promote active learning
- Highlighted learning outcomes which deepen students understanding of the importance of microbes, health and medicine
- Encourage students to take more responsibility for their own health
- Highlight the importance of prudent antibiotic use

The pack may be used in isolation or in conjunction with the presentations, images and videos on the e-Bug website.

We would like to thank everyone involved in the development of this resource which will help the next generation of adults to use antibiotics more wisely, especially the teachers and students across the UK, France and the Czech Republic who participated in focus groups and the evaluation process and helped ensure that these materials are not only fun and exciting but also effective!

As educators, your feedback is invaluable to us. Your comments will help the e-Bug resource grow and evolve. Please send any comments, queries and suggestions to

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Or alternatively visit the e-Bug website at [www.e-bug.eu](http://www.e-bug.eu) or e-mail us at [e-Bug@hpa.org.uk](mailto:e-Bug@hpa.org.uk)

We do hope you enjoy using e-Bug and will find this an invaluable addition to your classroom.



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# e-Bug

**A pan European educational resource covering the world of  
microbes and disease**

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Made possible by DG-Sanco of the European Commission





# Pack Content

## 1. Micro-organisms

### 1.1 An Introduction

Students learn about the different types of microbes – bacteria, viruses and fungi. They learn that microbes have different shapes and that they are found everywhere.

### 1.2 Useful Microbes

A yeast racing competition is used to demonstrate to students that microbes can be beneficial.

### 1.3 Harmful Microbes

Close examination of various illnesses illustrates to students how and where in the body harmful microbes cause disease. Students test their knowledge of harmful microbes by completing a crossword puzzle and word hunt.

## 2. Spread of Infection

### 2.1 Hand Hygiene

Through a classroom experiment students learn how microbes can spread from one person to another through touch and why it is important to wash hands properly.

### 2.2 Respiratory Hygiene

In this fun experiment students learn how easily microbes can be spread through coughs and sneezes by recreating a giant sneeze.

### 2.3 Food Hygiene

Students make a chicken sandwich for their classmates and observe just how far they have spread harmful microbes.

## 3. Prevention of Infection

### 3.1 The Body's Natural Defences

A detailed presentation and animations showing how the body fights harmful microbes on a daily basis. This section provides the basic knowledge requirements for the final two sections of this resource.

### 3.2 Vaccinations

Students use their reading comprehension and creative skills to answer questions on, and act out, the discovery of vaccinations by

## 4. Treatment of Infection

### 4.1 Antibiotic Use and Medicine

Through teacher-led discussion and debate, students learn the importance of using antibiotics and other medicines appropriately.







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Influenza

## National Curriculum Links

### Key Stage 2

Sc1: 2a, 2b, 2f, 2h

Sc2: 5a, 5f

### Estimated Teaching Time

50 minutes

# 1.1 Micro-organisms An Introduction

In this section students are introduced to the world of microbes, firstly by exploring the different types and shapes of microbes and later, by close examination of beneficial and harmful microbes.

The introductory activity allows students to combine their observational and creative skills to make a microbe of their own choice hence reinforcing various microbial types and shapes.

The extension activity *Microbe Mania* reiterates the classroom lesson and allows students to decide whether the microbe being discussed is a bacterium, virus or fungus!

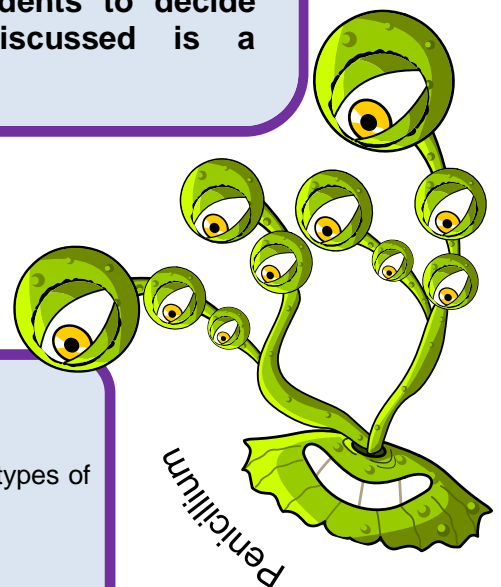
### Learning Outcomes

#### All students:

- Will know that bacteria, viruses and fungi are three different types of microbe
- Will understand that microbes are found everywhere

#### More able students:

- Will know that microbes come in different shapes and sizes





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# 1.1 Micro-organisms

## An Introduction

### Key Words

Bacteria  
Bug  
Cell  
Disease  
Fungi  
Germ  
Microbe  
Micro-organism  
Microscope  
Pathogen  
Probiotic  
Viruses

### Materials Required

#### Per Student

- A copy of [SH 1](#)
- A copy of [SW 1](#)
- A copy of [SW 2](#)
- Petri dish (optional)
- Microbial images from [www.e-bug.eu](http://www.e-bug.eu)

#### Per Group

- Play dough in a variety of colours (for home made recipe see [TS 4](#))

### Available Web Resources

- A demonstration film of the activity
- A variety of microbial photographs

### FASCINATING FACT

Anthony van Leewenhoek created the first ever microscope in 1676. He used it to examine various items around his home and termed the living creatures (bacteria) he found on scrapings from his teeth 'animalcules'.

### Background Information

Micro-organisms, also known as germs, bugs or microbes, are tiny living organisms too small to be seen with the naked eye. They are found almost everywhere on earth. Some microbes are beneficial and others can be harmful to humans (this will be explored in later sections). Although extremely small, microbes come in many different shapes and sizes. There are three main groups of microbes:

**Viruses** are the smallest of the microbes and are generally harmful to humans. Viruses cannot survive by themselves. 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!

**Fungi** are multi cellular organisms that can be both beneficial and harmful to humans. Fungi obtain their food by either decomposing dead organic matter or by living as parasites on a host. Fungi can be harmful by causing infection or being poisonous to eat; others can be beneficial or harmless, e.g. *Penicillium* which produces the antibiotic penicillin. There are also fungi that are not microbes and some that can be eaten like *Agaricus*, commonly known as the white button mushroom.

**Bacteria** are single-celled organisms that can multiply exponentially once every 20 minutes. During their normal growth, some produce substances (toxins) which are extremely harmful to humans and cause us disease (*Staphylococcus*); other bacteria are completely harmless to humans and others can be extremely useful to us (*Lactobacillus* in the food industry), some are even necessary for human life such as those involved in plant growth (*Rhizobacterium*). Harmless bacteria are called non-pathogenic, while harmful bacteria are known as pathogenic. Over 70% of bacteria are non-pathogenic.

Bacteria can be simply divided into three groups by their shapes – cocci (balls), bacilli (rods) and spirals. Cocci can also be broken down into three groups by how the cocci are arranged: staphylococci (clusters), streptococci (chains) and diplococci (pairs). Scientists use these shapes to tell which infection a patient has.

### Advance Preparation

- Prepare a copy of [SW 1](#) and [SW 2](#) for each student.
- Prepare [SH 1](#) poster for the classroom or on the white board.
- Purchase or follow the recipe in [TS 4](#) to make play dough in a variety of colours.
- Download a variety of microbe images from [www.e-bug.eu](http://www.e-bug.eu) for student viewing.





# 1.1 Micro - organisms

## An Introduction

# Lesson Plan

### Introduction

1. Begin the lesson by asking children what they already know about germs or bugs. Ask the children if they have, or anyone in their family, ever been sick? What was the disease and what do they think caused it?
2. Explain to the children that some diseases called infections are caused by germs and that these are tiny living organisms called microbes. Show the children that there are three different types of microbe: bacteria, viruses and fungi. Use the colour poster provided ([SH 1](#)), which is also found on the e-Bug website ([www.e-bug.eu](http://www.e-bug.eu)), for whiteboard presentation format.
3. Explain that these microbes are so small that they can only be seen through a microscope. Use the web activity or provide students with [SH 2](#) to demonstrate the different sizes of microbes.
4. Emphasise that although some microbes cause disease, there are also beneficial microbes. Ask children to identify some useful microbes. If they cannot, provide examples for them e.g. *Lactobacillus* in yogurt and probiotics drinks, penicillin from fungi, etc.
5. Highlight to the class that microbes can be found EVERYWHERE: floating around in the air we breathe, on the food we eat, on the surface of our bodies, in our mouth, nose and gut/tummy.

### Main Activity

1. This activity can be done either individually or in groups.
2. Provide each group with either a colour handout ([SH 1](#)) of the different types of bacteria or place colourful posters on the classroom walls from the website [www.e-bug.eu](http://www.e-bug.eu). These handouts will show the range of shapes and sizes of microbes with names and whether they are useful or harmful microbes.
3. Provide each group with play dough in a variety of colours, petri dishes and a copy of [SW 1](#).
4. Ask each child / group to recreate a microbe or groups of microbes in their petri dish based on the coloured images provided.
5. Each child must decide whether or not they think their microbe is useful or harmful and provide its name. It is important to let the children get as creative as possible whilst taking into consideration the actual structure of microbes.
6. Remind the class that fungi are the largest microbes and viruses are the smallest.
7. If time permits, students can then present their microbes to the class.





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## 1.1 Micro - organisms An Introduction

# Lesson Plan

### Plenary

Check for understanding by asking the children the following questions:

1. What are the most common types of microbe?  
*There are three main types of microbe known as bacteria, viruses and fungi.*
2. What are germs?  
*A germ is another name used to describe a harmful microbe.*
3. Where is a microbe found?  
*Microbes are found EVERYWHERE, floating around in the air we breathe, on the food we eat, on the surface of our bodies, in our mouth, nose and gut/tummy.*
4. Are all microbes harmful?  
*No, although there are microbes which can be harmful to us there are also a lot of microbes that are very useful to us that we use every day, for example, Saccharomyces (fungi) is used to help bread rise, Lactobacillus (bacteria) help make yogurt and cheese.*
5. What are the different shapes of bacteria?  
*Spirals (Campylobacter), Rods (Lactobacilli) and Balls (Staphylococcus).*

### Extension Activity

1. Provide each student with a copy of **SW 2** and **SH 1**.
2. By reading the descriptions and using the information on their handouts students must decide whether the microbes are bacteria, virus or fungi.
  - a. *Staphylococcus is a bacterium.*
  - b. *Lactobacillus is a bacterium.*
  - c. *Dermatophytes are fungi.*
  - d. *Influenza is a virus.*
  - e. *Penicillium is a fungus.*
  - f. *Campylobacter is a bacterium.*



# 1.1 Micro - organisms

## An Introduction

### Home-made play dough Recipe

Play dough is a soft, pliable material that can keep children occupied for considerable lengths of time. Play dough is available to purchase under a range of different brand names but it may be cost effective to make your own. Home made play dough has the added advantage that you can choose your preferred palate of colours. The home made play dough is non-toxic, brightly coloured and easily sculpted making it an ideal tool for creative play and this activity.

#### Ingredients

- 1 cup of plain flour
- 1 cup of water
- 1/2 cup of salt
- 2 tablespoons of cream of tartar
- 2 tablespoons of oil
- Food colouring

#### Method



**Mix** together the **dry ingredients**



**Add** the **water** and **mix** until smooth



**Add** the **food colouring** followed by the **oil**



**Cook** on a **medium heat**, **stirring constantly**, until the dough leaves the side of the pan in a ball



**Allow** to **cool** before use





# What are Microbes?

- Microbes are living organisms
- They are so small we need a microscope to see them
- They come in different shapes and sizes

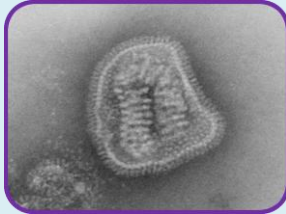
- They are found EVERYWHERE!
- Some microbes are useful or even good for us
- Some microbes can make us ill



There are **3** different types of microbes:

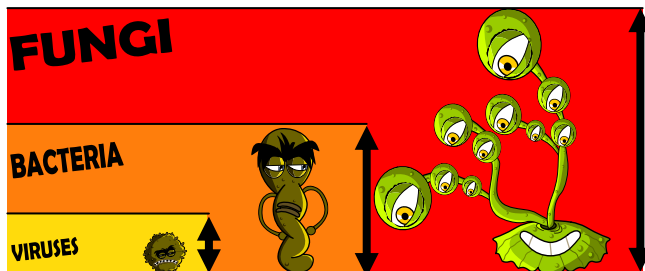
## VIRUSES

### Influenza



- Viruses are even smaller than bacteria and can sometimes live INSIDE bacteria!
- Some viruses make us sick.
- Diseases like CHICKENPOX and the FLU are caused by viruses.
- Viruses can spread from one person to another but it depends on the type of virus.

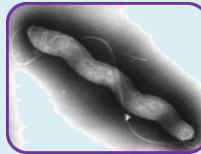
### Microbe Size



## BACTERIA

- There are three different types of bacteria. They look like:

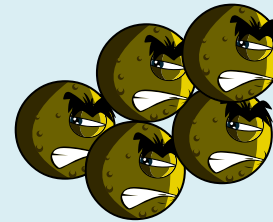
### Spirals (Campylobacter)



### Rods (Lactobacillus)



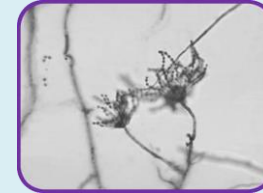
### Balls (Staphylococcus)



- They are so small that 1000s of bacteria could fit on the full stop at the end of this sentence.
- Some bacteria are helpful in cooking, for example, making yogurt and cheese.
- Some bacteria are harmful and cause infection.

## FUNGI

### Penicillium



### Dermatophyte



- Fungi are the largest of all microbes.
- Fungi can be found in the air, on plants and in water.
- Mould, which grows on bread, is a type of fungus.
- Some antibiotics are made by fungi!





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How  
big  
is  
a

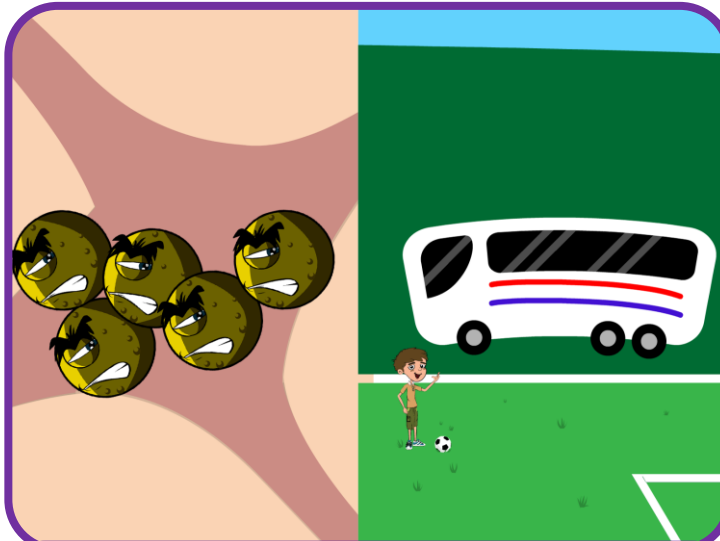
Microbe?



1. If you were as big as EUROPE...



2. A FUNGUS would be the size of a football pitch!



3. A BACTERIUM would be the size of a BUS!



4. A VIRUS would be the size of a FOOTBALL!





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# What are Microbes?

## Make your own Microbe



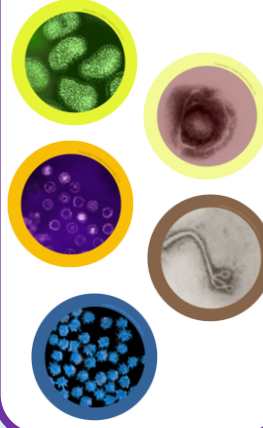
Design a microbe of your choice, either a bacterium, a virus or a fungus using the materials provided.

Before you start, decide if your microbe will be beneficial or harmful! Here are some pictures which might help!

### Bacteria



### Viruses



### Fungi



### Top Tip

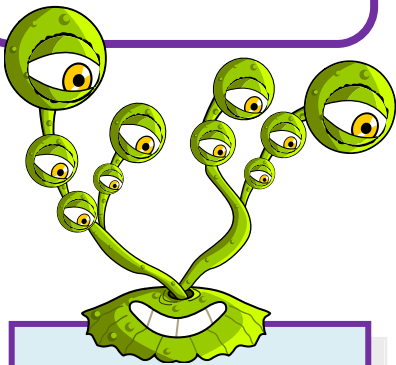
Bacteria come in lots of different shapes and sizes – some are round like balls, some are like spirals and some are long like rods. Some even use tail like structures to help them swim and move!

## My Observations

1. Is it a beneficial or harmful microbe?

2. Choose a name for your microbe.

## Draw your microbe here



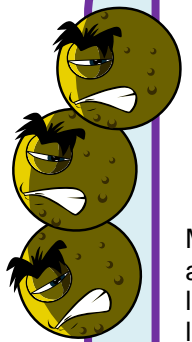
### Fascinating Fact

YOU are home to 1000 million microbes!

This is a picture of my \_\_\_\_\_







12

# Microbe Mania

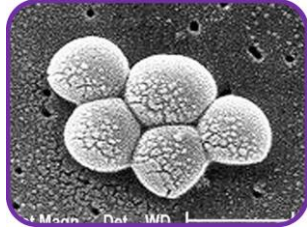
There are 3 different types of microbe – bacteria, viruses and fungi.

From the pictures and descriptions, can you work out which microbe is which?

### Hint

Remember there are three different types of bacteria

- rods
- spirals
- balls



My name is **Staphylococcus**. I am round in shape and I like to live in your nose or armpit! If I live on your skin I can give you spots. If I get into your bloodstream I can make you ill! What am I?

*Staphylococcus* is a:

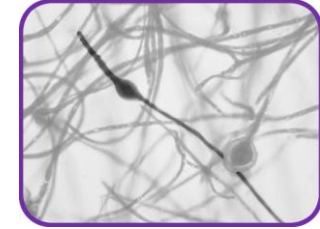
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My name is **Lactobacillus**. People call me 'friendly' because I change milk into yogurt! When you eat me in yogurt I live in your guts and help you digest other food. What am I?

*Lactobacillus* is a:

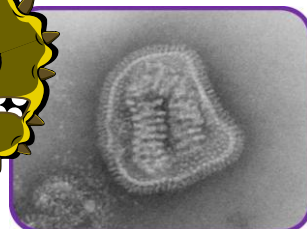
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I'm called a **Dermatophyte** and I like to live on your skin. I especially like living in damp places like between the toes on sweaty feet! When I live there I give people athlete's foot! What am I?

Dermatophytes are:

\_\_\_\_\_



My name is **Influenza** but my friends call me the 'flu'. I'm very generous; I like to give people headaches and fever. I easily spread from person to person through coughing and sneezing. What am I?

*Influenza* is a:

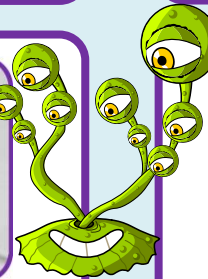
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My name is **Penicillium** and you'll find me growing on old oranges or stale bread making them look mouldy. Humans use me to make an antibiotic known as Penicillin which can make them better, but only from bacterial infections! What am I?

*Penicillium* is a:

\_\_\_\_\_



My name is **Campylobacter**. I have a pretty spiral shape and I like to live in chickens but if I get into your tummy I make you very ill – I can give you diarrhoea! What am I?

*Campylobacter* is a:

\_\_\_\_\_







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Yeast

## National Curriculum Links

### Key Stage 2

Sc1: 1a, 1b, 2a, 2b, 2c, 2d, 2g, 2j  
Sc2:1a, 2b, 2g, 5f

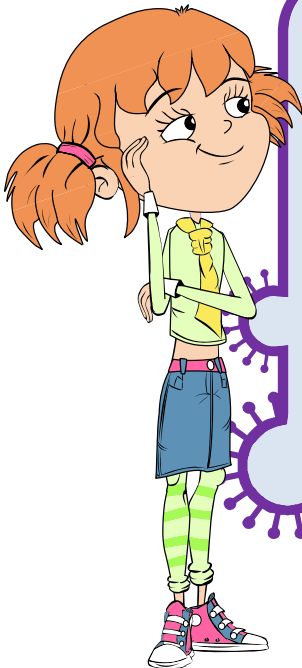
### Unit of Study

Unit 6 – Micro-organisms

### Estimated Teaching Time

50 minutes

# 1.2 Micro-organisms Useful Microbes



Section 1.2, Useful Microbes, highlights to students that not all microbes are harmful by examining the various ways and means we utilise certain organisms for our benefit.

In the activity, *Yeast Races*, students observe first hand how microbes can be put to good use in the food industry by observing how yeast makes dough rise through the process of fermentation.



### Learning Outcomes

#### All students:

- Will understand that some microbes can help keep us healthy
- Will know that some microbes can be put to good use



## 1.2 Micro-organisms

### Useful Microbes

#### Key Words

Culture  
Fermentation  
Incubate  
Micro-organisms  
Probiotics

#### Materials Required

##### Per student

- A copy of [SW 1](#)
- A copy of [SH 1](#)

##### Per group

- 2 plastic cups
- Flour
- Yeast solution
- Sugar
- 2 Graduated cylinders (or other container with measurements on the side)
- Basin
- Hot water

#### FASCINATING FACT

Elie Metchnikoff won the Nobel Prize in 1908 for his 'discovery' of probiotics. He was convinced that Bulgarian peasants lived longer than other people because of the microbes in the sour milk they drank! The microbes were later identified as *Lactobacillus bulgaricus*.

#### Available Web Resources

- A demonstration of this activity
- An alternative 'yogurt making' activity

USE  
TS 1

#### Background Information

Microbes are single-celled organisms most of which are helpful or beneficial, although some of them cause illness and disease. One of the main ways in which microbes are beneficial is in the food industry. Cheese, bread, yogurt, 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 yogurt. So much acid is produced in fermented milk products that few potentially harmful microbes can survive there.

*Lactobacillus* is generally referred to as a good or 'friendly' bacterium. 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 our yogurts and probiotic drinks.

The 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.

#### Advance Preparation

1. Copy [SW 1](#) and [SH 1](#) for each student.
2. Purchase flour, sugar and dried yeast.
3. Prior to starting the activity make up a liquid yeast solution as outlined on pack purchased. This may vary between different brands. **If made too far in advance the yeast will start to ferment.**

**NB:** make up the yeast solution as outlined with water and dried yeast, do NOT add sugar until stated in the main activity.

#### Alternative Suggestion

If graduated cylinders are not available, tall glasses may be used as an alternative by marking the outside of the glass at the base line level and at every allocated time point and then measuring the distance between each line.



## 1.2 Micro-organisms Useful Microbes

# Lesson Plan

### Introduction

1. Begin the lesson by explaining that microbes can have both harmful and beneficial effects on our health. Ask the class what they know about beneficial or 'friendly' bacteria. Many children will have already heard about probiotic bacteria in yogurts.
2. Explain that microbes are helpful in the breakdown of dead animals and plants, in helping animals and humans digest foods and in turning milk into yogurt, cheese and butter.
3. Highlight that bread dough rises through the action of helpful fungus known as yeast. The yeast eats the sugars present in food and produce acids. These acids change the taste, smell and form of the original foodstuff.
4. Tell the class that in this activity they are going to see exactly how we can use useful microbes to make bread rise.

### Main Activity

1. This activity is for groups of 2 – 5 students.
2. Highlight to the students that a useful fungus known as yeast is used to make bread. The yeast helps the bread rise by a process known as fermentation.
3. Supply the class or groups with the Yeast Races Recipe ([SH 1](#)). The recipe can also be found on our website [www.e-bug.eu](http://www.e-bug.eu) for white board use.
4. Have students carry out the activity in their groups. When the recipe is complete, students should observe the yeast and record their observations on the student worksheet ([SW 1](#)).
5. Can the class explain why the yeast and sugar solution moved faster than the yeast alone?  
*Fermentation was carried out at a faster rate when the sugar was present.*

### Plenary

1. Check for understanding by asking the class the following questions:
  - a. What is the process which caused the yeast mixture to rise?  
*Yeast growing and using the sugars for energy; the yeast produce gas bubbles which cause the dough to rise.*
  - b. What would have happened if there were no live yeast in the mixture?  
*Nothing, it's the growing yeast that cause the breakdown of sugars and makes the dough rise.*
  - c. Why was the mixture kept in a basin of warm water?  
*Most microbes prefer to grow at 37°C and will multiply faster if grown at this temperature. The faster the microbes grow the more breakdown of sugars will occur and the faster the yeast will rise up the cylinder.*
  - d. What other food products are made using bacteria or fungi?  
*Cheese, bread, wine, beer, sour cream.*

### Extension Activity

Each student should go home and search in their kitchen for food they think may contain microbes, they should identify whether they think these foods should be kept in the cupboard or in the fridge to slow down growth of bad microbes which may be present.





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# Yeast Races



**Label** one of your plastic cups **A** and one **B**



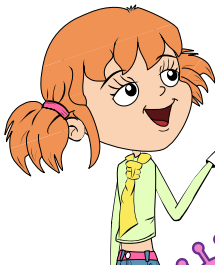
Add **4 dessert spoons** of **flour** to each of your cups



Add enough **yeast solution** to plastic **cup A** until it has the consistency of a thick milkshake.



Add enough **yeast and sugar solution** to plastic **cup B** until it has the consistency of a thick milkshake.



Pour the contents of **cup A** into **graduated cylinder A** until it reaches about **30ml**



Pour the contents of **cup B** into **graduated cylinder B** until it reaches about **30ml**



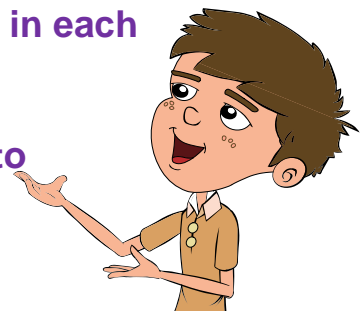
**Record** the exact **height** of the dough in each



**Place** both measuring cylinders into a **basin** of hot water



**Measure** the height of the dough every **5 minutes** for 30 minutes





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# Yeast Races

## Procedure



1. Follow the instructions in the Yeast Races Recipe.

## My Results

Time	YEAST ALONE	
	Volume of dough	Change in volume of dough / ml
0	0	0
5		
10		
15		
20		
25		
30		

YEAST AND SUGAR	
Volume of dough	Change in volume of dough / ml
0	0

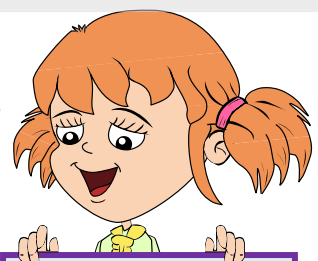


### Did you know?

The average adult carries approximately 2kg of good microbes in their guts – the same weight as 2 bags of sugar!

## My Conclusions

1. What caused the dough to rise up the container?  
\_\_\_\_\_
2. What is this process called?  
\_\_\_\_\_
3. Why did the dough in container B move faster than container A?  
\_\_\_\_\_
4. What other food products are the result of bacteria or fungi growing and changing substances?  
\_\_\_\_\_



### Fascinating Fact

There are trillions friendly bacteria in the average human gut.

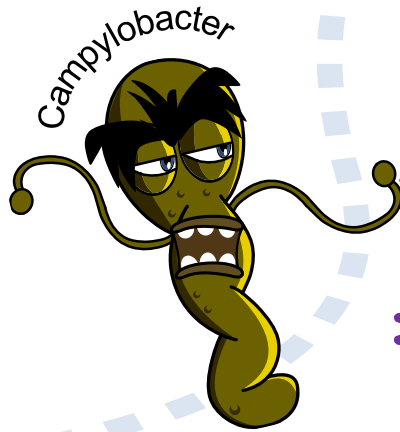








## National Curriculum Links



### Key Stage 2

Sc1: 1a, 2a, 2b  
Sc2: 1a, 2g, 5f

### Unit of Study

Unit 6 – Micro-organisms

### Estimated Teaching Time

50 minutes

# 1.3 Micro-organisms Harmful Microbes



Section 1.3, Harmful Microbes, introduces students to the variety of health issues caused by harmful microbes.

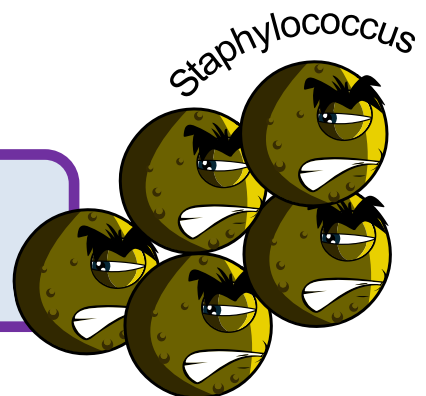
Students are encouraged to discuss as a class how some microbes can be harmful and what they can do to prevent themselves from getting ill. This lesson also highlights that not all illnesses are caused by microbes.

The word searches and crosswords found in the extension activity help to reinforce words associated with harmful microbes and illness.

### Learning Outcomes

#### All students:

- Will know that sometimes microbes can make us ill





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## 1.3 Micro-organisms Harmful Microbes

### Key Words

Bacteria  
Colonise  
Dermatophytes  
Flora  
Fungi  
Germs  
Hygiene  
Infected  
Infectious  
Pathogens  
Toxin  
Virus

### Materials Required

#### Per Student

- Copy of [SW 1](#)
- Copy of [SW 2](#)

#### Per Class/Group

- Copy of [SH 1](#)
- Copy of [SH 2](#)

### Available Web Resources

- Images of microbes found in section 1.1
- [SH 1](#) and [SH 2](#) available in MS PowerPoint format.

### Background Information

Some microbes can be harmful to humans and can cause disease: the *Influenza* virus can cause the flu, *Campylobacter* bacteria can cause food poisoning and the dermatophyte fungi, such as *Trichophyton*, can cause diseases such as athlete's foot and ringworm. Microbes such as these are known as **pathogens** or **germs**. 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 feel ill or in worse case scenario, damage tissues and organs.

Viruses act like parasites. On entering our bodies they require a host cell to survive. Once inside a cell, they multiply and burst free when fully grown and in doing so destroy the host cell.

Fungi generally do not kill their host. **Dermatophytes** prefer to grow or colonise under the skin and the products they produce while feeding cause swelling and itching.

Someone who has harmful disease-causing microbes in them 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, 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 i.e. the normal flora in our gut keep us healthy by preventing harmful bacteria like *Clostridium difficile* multiplying. When our normal body flora is compromised, *Clostridium difficile*, can grow and cause diarrhoea and in very severe conditions, cause perforation (a tear or puncture) of the gut.

### Advance Preparation

1. Prepare a copy of [SW 1](#) and [SW 2](#) for each student.
2. Download [SH 1](#) and [SH 2](#) from the website, [www.e-bug.eu](http://www.e-bug.eu), or copy these sheets for the class.





## 1.3 Micro-organisms Harmful Microbes

# Lesson Plan

### Introduction

1. Begin the lesson by explaining to the class that sometimes microbes can be harmful to humans. Ask them if they know what makes them ill. Find out how many different words they have for microbes – germs, bugs, etc.
2. Explain to the class that the germ is an everyday word that refers to the bacteria, viruses and fungi that make you sick. Discuss the various microbes with the class and the illnesses they can cause. The microbe images found on the website, [www.e-bug.eu](http://www.e-bug.eu), in section 1.1 may help students visualise these harmful microbes.
3. Highlight to the class that microbes have adapted to live everywhere, in our classrooms, houses, bedrooms, all over our body and can grow easily on food!
4. Tell the class that harmful disease-causing microbes that can spread easily from one person to another are called infectious diseases because they can cause an infection.

### Main Activity

1. This activity is best suited as a class discussion followed by an individual student activity.
2. Show the class each of the picture scenarios (1-6) in teacher section **SH 1** and **SH 2**. The handouts can be shown to the class by photocopying for each person in the class, printing onto acetates for overhead projection or by displaying on the whiteboard from the e-Bug web site ([www.e-bug.eu](http://www.e-bug.eu)).
3. For each scenario, ask the class whether they think a microbe is making Amy or Harry sick. Tell the class each of the stories as explained in **TS 3**. Continue the discussion by asking if anyone in the class has ever suffered from any of Amy's or Harry's symptoms and if so, what kind of treatment they had.
4. **Remember:** There are hand washing, respiratory and food hygiene activities in later sections of the e-Bug resource which will cover these topics in more detail.
5. If time permits, provide the class with a copy of **SW 1** and **SW 2**. The word search and crosswords contain a list of words associated with harmful microbes and illness which will help reinforce the learning outcomes of this lesson.

### Plenary

1. Check for understanding by asking the students the following questions:
  - a. What causes an infection?  
*An infection is when harmful microbes get inside your body and grow causing the infected person to get ill.*
  - b. Are sore throats always caused by harmful microbes?  
*Not all sore throats are caused by harmful microbes, sometimes coughing can cause our throats to become red and sore too.*
  - c. Are all illnesses caused by microbes?  
*No, illnesses such as asthma and hay fever are not caused by microbes.*
  - d. Can you think of any infections caused by harmful microbes?  
*Athlete's foot, influenza, measles.*





\* \* \*  
e-Bug  
\* \* \*

## 1.3 Micro-organisms Harmful Microbes

### Teaching Points



Amy likes to keep her hands and nails clean. If we look closely at Amy's hands we can see that they are covered in lots of tiny microbes. These microbes are good microbes that live on our skin and help keep us healthy.



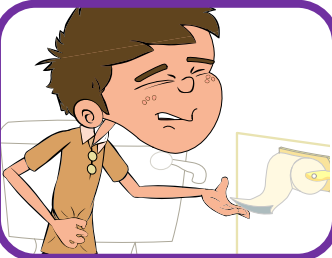
Harry is always out playing football and having fun with his friends, however he doesn't worry about washing his hands very often. If we look closely at Harry's hands we can see that they too are covered with lots of tiny microbes although some of these are bad and could make him very ill if they got inside his body.



Amy isn't very well, she has a really sore throat. Sometimes sore throats are caused by coughing and a runny nose. This can make the throat swell up and become quite painful, if this happens then Amy should drink lots of fluids and take painkillers. Sometimes, however, bacteria (e.g. *Streptococcus*) and viruses can also cause us to have a sore throat.



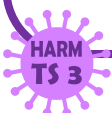
Do you think that Harry is ill because of microbes here? The answer is no, Harry has a condition known as asthma which causes him to get out of breath very easily. Asthma is a disease of the lungs and airways but is not caused by microbes. It is important to remember that not all illnesses are caused by microbes.



What do you think is wrong with Harry in this picture? Poor Harry has eaten undercooked chicken at a BBQ and has now got food poisoning caused by *Campylobacter*. There are lots of microbes on meat, which although they don't harm the animal can make us very ill! It is important to cook food properly to kill any harmful microbes which may be present.



Amy plays tennis and she has sweaty smelly feet. She is always in a hurry so doesn't wash or dry her feet properly. Her feet smell and are also very itchy and swollen in between her toes. This is because fungi known as dermatophytes like to live between the toes, especially if they are damp! They cause a disease known as athlete's foot which causes your toes to swell up, the skin between them crack and be VERY itchy and sometimes smelly!

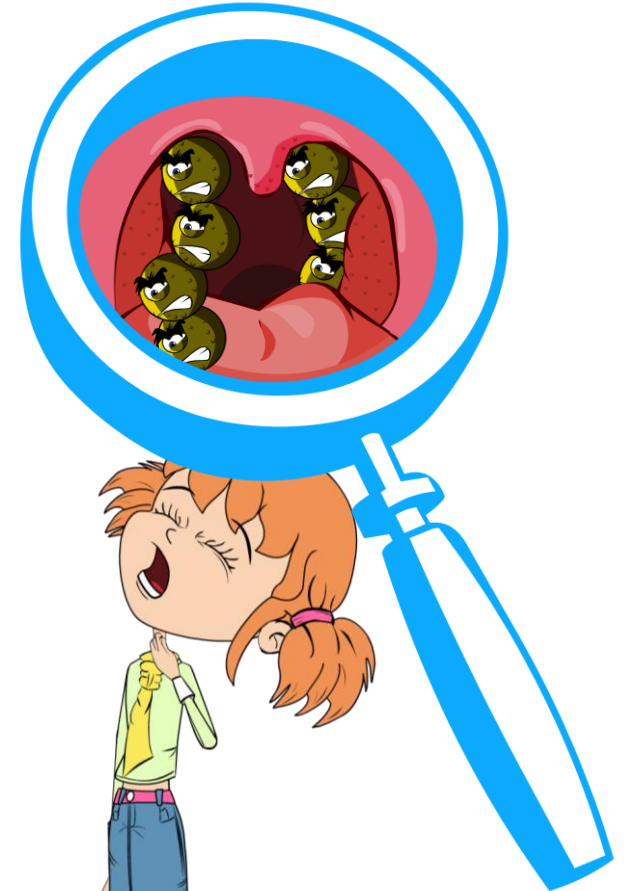






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# Harmful Microbes

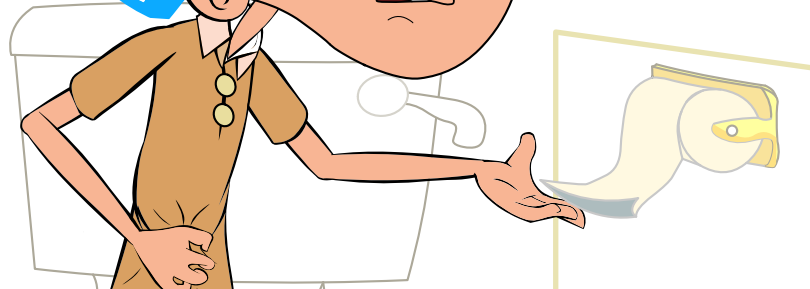
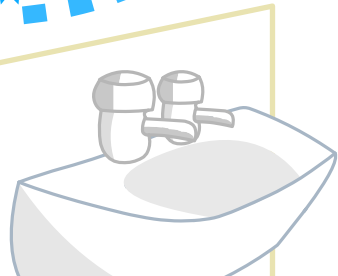
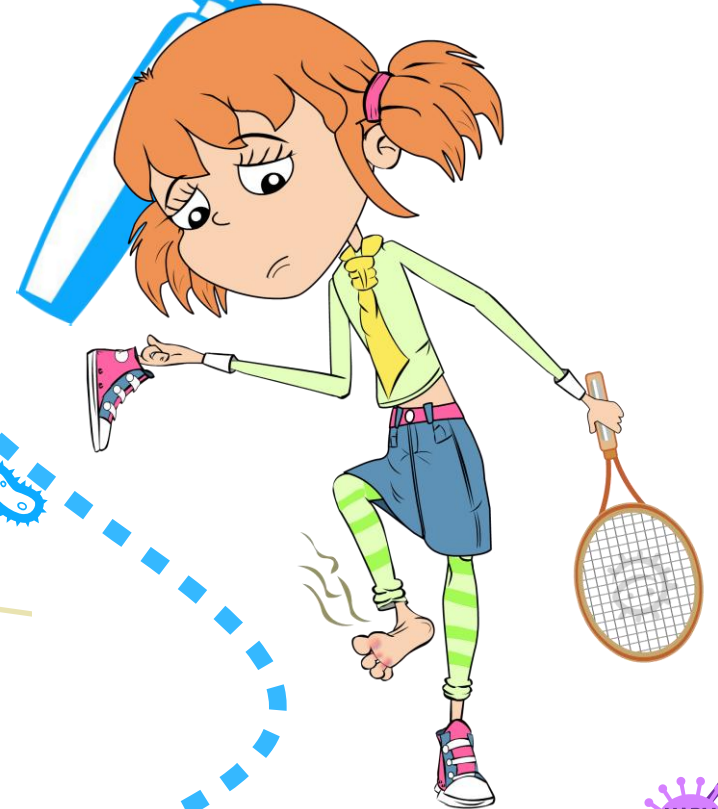
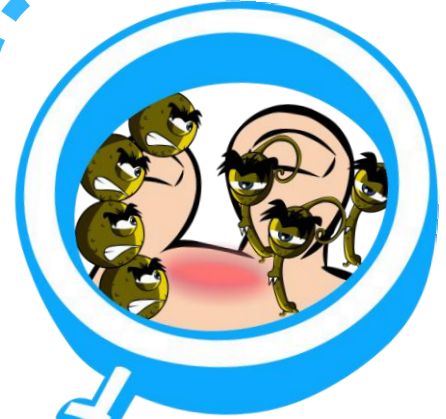
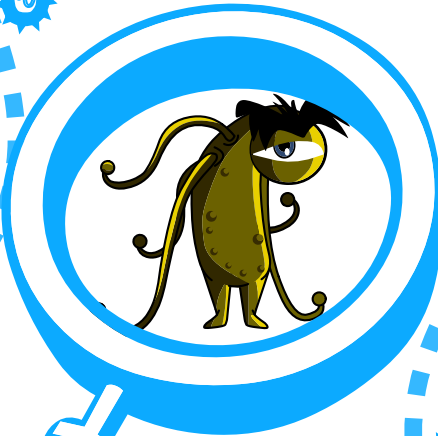




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# Micro-organisms

## Harmful Microbes





# Bad Bug Challenge!



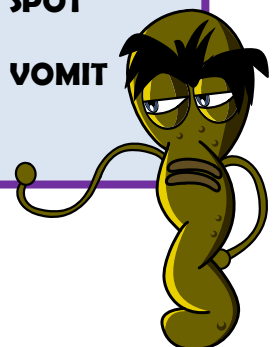
Can you find all the words associated with Bad Bugs in the word search below? Remember that the words can be horizontal (across), vertical (down) or diagonal (top left to bottom right).



F	C	E	A	R	T	M	Y	Y	U	A	N	S	D	F
F	O	M	G	B	F	L	U	M	B	H	N	H	J	K
Z	L	O	N	Z	R	W	K	A	Y	E	A	E	A	L
F	D	S	D	H	G	D	A	S	T	H	M	A	T	A
V	B	H	N	P	H	N	J	O	H	D	D	D	G	T
S	V	V	A	C	O	U	G	H	N	C	I	A	B	H
M	S	O	S	X	J	I	D	F	B	G	R	C	G	L
E	T	G	M	Z	U	N	S	A	M	A	T	H	A	E
A	N	M	D	I	A	R	H	O	E	A	Y	E	J	T
S	Z	X	C	V	T	B	G	T	N	D	H	J	H	E
L	R	T	A	Y	U	N	I	A	O	I	A	F	G	S
E	Q	W	E	R	I	N	F	L	U	E	N	Z	A	F
S	P	O	T	I	O	P	L	B	K	J	D	G	G	O
A	S	D	M	S	L	E	E	P	Y	E	S	S	F	O
H	A	Y	F	E	V	E	R	N	F	G	N	H	K	T



- |                 |                    |                       |              |
|-----------------|--------------------|-----------------------|--------------|
| <b>COUGH</b>    | <b>HAYFEVER</b>    | <b>ATHLETES FOOT</b>  | <b>COLD</b>  |
| <b>ASTHMA</b>   | <b>SLEEPY</b>      | <b>FOOD POISONING</b> | <b>SPOT</b>  |
| <b>MEASLES</b>  | <b>DIRTY HANDS</b> | <b>FLU</b>            | <b>VOMIT</b> |
| <b>HEADACHE</b> | <b>INFLUENZA</b>   |                       |              |



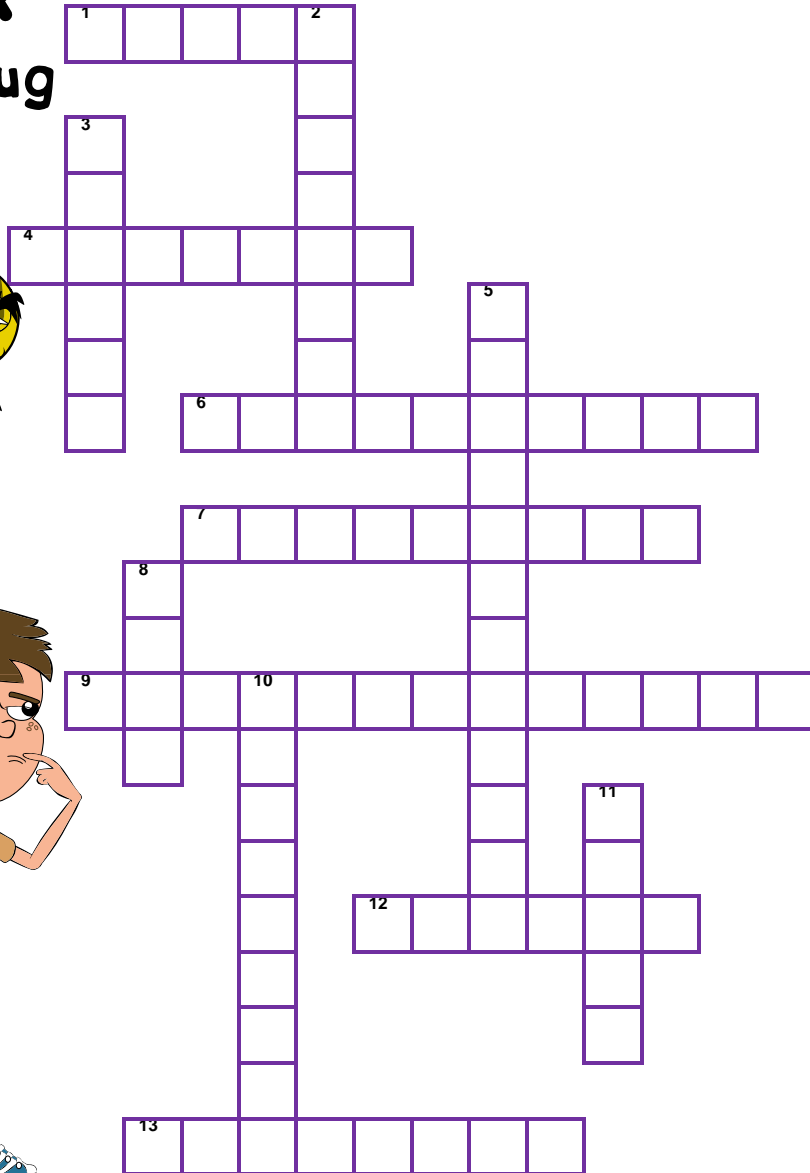




e-Bug



# Bad Bug Challenge!



## ACROSS

- I make you do this when you have a cold to spread microbes by causing a tickle in your throat.
- I am a viral disease that can give you swollen itchy red spots all over your body.
- I am a part of your body and spread microbes from person to person. Washing me gets rid of bad microbes (2 words).
- I am a viral disease that will make you hot and sweaty.
- You will get me if you don't cook your meat properly or wash your hands after handling raw meat (2 words).
- I am a disease of the lungs, not caused by microbes. I make you so short of breath that you need to use an inhaler!
- I am another word for a pain in your head.

## DOWN

- I make your eyes swollen and itchy. I am not caused by a microbe. I am caused by flower pollen.
- How you feel when your body is fighting infection.
- I am a fungal infection of your feet. I make your toes itchy. I spread if you don't wash and dry your feet well! (2 words).
- I am often seen on teenager's faces. I am sometimes caused by microbes on the skin.
- Bad microbes in your tummy can sometimes cause this. If you don't wash your hands after going to the toilet it can spread around your school.
- Watch out! Bad tummy microbes can sometimes take you by surprise and make you do this.



## ANSWERS

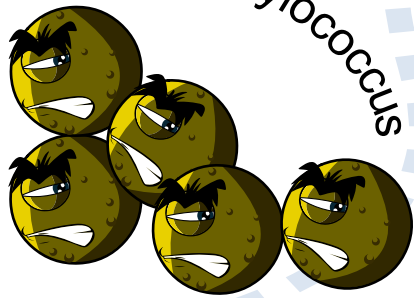
INFLUENZA	HAYFEVER	MEASLES	HEADACHE	DIARRHOEA
ASTHMA	ATHLETES FOOT	VOMIT	SPOT	COUGH
SLEEPY	DIRTY HANDS	FOOD POISONING		







Staphylococcus



## National Curriculum Links

### Key Stage 2

Sc1: 1a, 1b, 2a, 2b, 2c, 2d, 2e, 2f, 2g, 2h, 2i, 2j, 2k, 2l

Sc2: 2g, 5f

### Unit of Study

Unit 6 – Micro-organisms

### Estimated Teaching Time

50 minutes

## 2.1 Spread of Infection Hand Hygiene

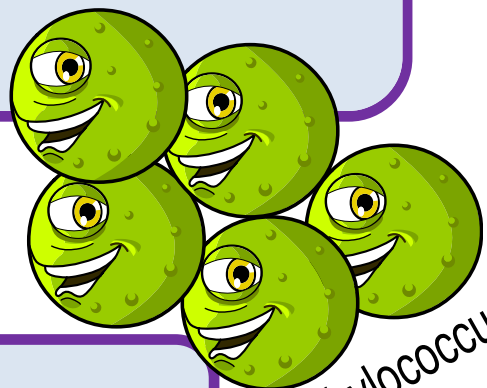
The Spread of Infection section aims to teach students how poor hand hygiene, respiratory hygiene and improper care with food can lead to the spread of microbes and disease.

In 2.1 Hand Hygiene, students carry out an experiment to observe how microbes can spread from person to person simply by shaking each others hands. They will also have to decide which

### Learning Outcomes

#### All students:

- Will understand that infection can be spread through unclean hands
- Will know that hand washing can prevent the spread of infection



Staphylococcus



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## 2.1 Spread of Infection Hand Hygiene

### Key Words

Antibacterial soap  
Contagious  
Hygiene  
Infection  
Infectious  
Transfer

### Materials Required

#### Per student

- Copy of [SW 1](#)
- Copy of [SW 2](#)

#### Per group

- Copy of [SH 1](#)
- Basin
- Hand soap
- Paper towels
- Cold or warm water
- Oil based Glo Gel and UV lamp **or** cooking oil and cinnamon

### Health and Safety

- If using cinnamon as an alternative to Glo Gel, take care of children with sensitive skin conditions
- Ensure that the lead students have no soap allergies or sensitive skin conditions

### Available Web Resources

- A demonstration of this activity
- A poster showing the recommended method of hand washing

### Background Information

Schools are a haven of harmful microbes that spread rapidly from child to child via touch. Washing your hands is one of the best ways to STOP harmful microbes from spreading and preventing us from getting sick.

Our hands naturally secrete oil which helps to keep our skin moist and stops it getting too dry. This oil, however, is a perfect place for microbes to grow and multiply and helps microbes 'stick' to our skin. Our hands are naturally covered by our useful bacteria – usually useful *Staphylococcus*. Washing our hands regularly helps to remove the other microbes we collect from our surroundings (e.g. home, school, garden, animals, pets, food). Some of these microbes can make us ill if eaten or breathed in.

Washing hands in water alone even in cold water will eliminate visible dirt and grime; however, soap is required to break up the oil on the surface of the hands which traps microbes.

Hands should be washed:

- before, during and after preparing food
- After using the bathroom
- After exposure to animals or animal waste
- After coughing, sneezing or blowing your nose
- If you're ill or have been around ill people

### Advance Preparation

1. Copy [SW 1](#) and [SW 2](#) for each student.
2. Copy [SH 1](#) for each group.
3. Arrange four desks side by side, each desk should contain either:
  - a. A sign reading 'No hand washing'
  - b. A basin of cold water, paper towels and a sign reading 'Wash in Cold Water'
  - c. A basin of warm water, paper towels and a sign reading 'Wash in Warm Water'
  - d. A basin of warm water, hand soap, paper towels and a sign reading 'Wash in Warm Water and Hand Soap'

### Alternative Suggestion

If Glo Gel and a UV lamp are unavailable, ask the student at the front to cover their hands in cooking oil or an equivalent non harmful oil and sprinkle well or cover with cinnamon or glitter.





## 2.1 Spread of Infection Hand Hygiene

# Lesson Plan

### Introduction

1. Begin the lesson by asking students how many have washed their hands today? Ask them why they washed their hands (*to wash away any microbes that might be on their hands*) and what would happen if they didn't wash away the microbes (*they might get ill as they will eat or breathe in harmful microbes from their dirty hands*).
2. Tell the students that we use our hands all the time, and that they pick up millions of microbes every day and that although many of these are harmless some could be harmful. Explain to the students that we spread our microbes to our friends and others through touch, and this is why we wash our hands.
3. Explain to students that they are going to do an activity to show them how best to wash their hands to remove any of the harmful microbes which may be on their hands.

### Main Activity

1. Divide the class up into four equal separate groups
2. Ask each student to stand in a row one behind the other and designate groups as follows
  - a. No hand washing
  - b. Wash hands in cold water
  - c. Wash hand in warm water
  - d. Wash hands in warm water with soap
3. Blindfold the lead person in each group and cover their hands in Glo Gel. The blindfold ensures that they don't wash their hands any better than normal. Ask the lead person to wash their hands according to the group they are in.
4. Once completed, they should take off their blindfold, turn around and shake hands with the person behind them. It is important that they shake hands firmly and well. The second person should then shake hands with the third person and so on until everyone in the group has shaken hands with the person in front of them.
5. When the task is complete, turn down the lights and shine the UV lamp over everyone's hands, starting with group A.
6. Ask students to fill out their answer sheets ([SW 1](#) and [SW 2](#)).

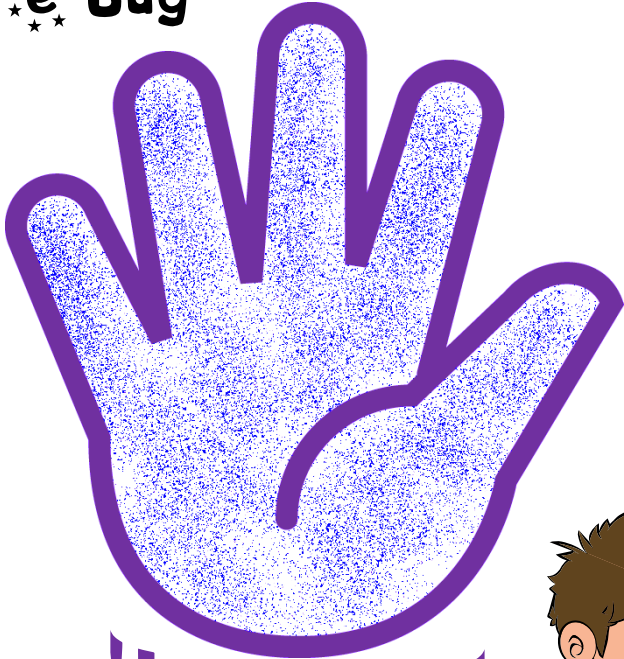
### Plenary

1. Discuss the results with the students. What results did they find the most surprising? Explain that the soap takes away the oil in the skin that the microbes use to stick to and hide in.
2. Discuss where the microbes on their hand may have come from. Emphasise to students here that not all the microbes on their hands are harmful; there may also be useful microbes there too!
3. Emphasise to students that we also need to wash hands properly. Highlight that bacteria like to hide in between fingers and under the nails! It is important to know both WHEN and HOW to wash our hands properly to prevent spreading microbes and potentially infection. It is not always easy to wash your hands in school; a solution may be to sneeze on your sleeve.

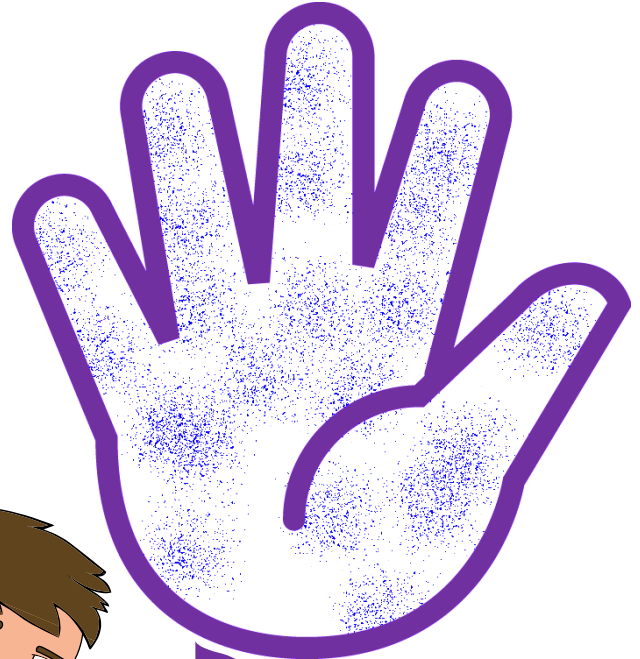




e-Bug



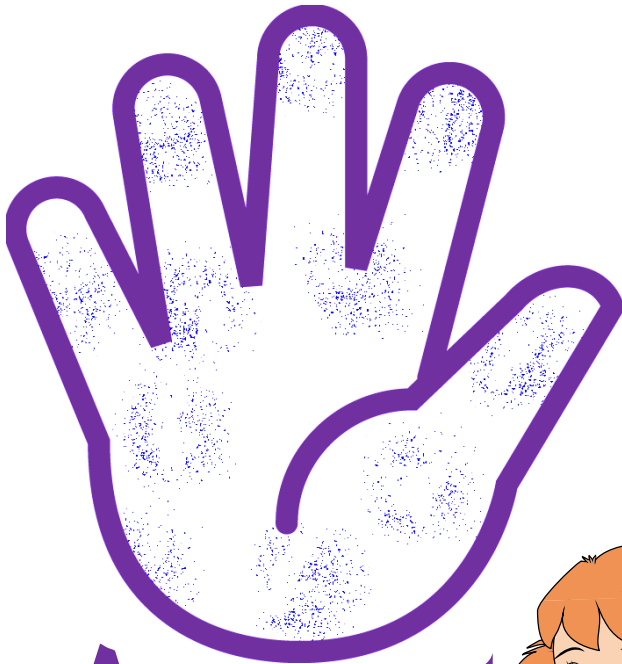
Very Dirty



Dirty



How clean are your hands?



A Bit Dirty



Clean





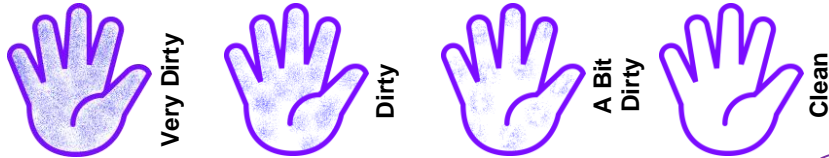
# Horrid Hands?



## Procedure

After the activity, write your results in the box provided using the guide below and see how far the microbes have spread!

What is the best way of washing hands to get rid of microbes?



## My Observations



	After washing (or not washing) and shaking hands				
	Student 1	Student 2	Student 3	Student 4	Student 5
No wash (control)					
Cold Water					
Warm Water					
Warm Water and Soap					

- On the next page draw where you saw microbes after hand washing and shaking, for your group only.
- The method of hand washing (not control) that **removed most** microbes from the lead person was:
  - Cold Water
  - Warm Water
  - Warm Water and Soap
- The method of hand washing (not control) that **removed fewest** microbes from the lead person was:
  - Cold Water
  - Warm Water
  - Warm Water and Soap
- The method of hand washing which **spread the most** microbes along the line was:
  - Cold Water
  - Warm Water
  - Warm Water and Soap
- The method of hand washing which **spread the fewest** microbes along the line was?
  - Cold Water
  - Warm Water
  - Warm Water and Soap
- Draw a graph of how far the microbes spread for all four groups (including control).



## My Conclusions

- What is the best way of getting rid of microbes from our hands?  
\_\_\_\_\_
- What difference does using soap make?  
\_\_\_\_\_
- When should we wash our hands?  
\_\_\_\_\_

**Fascinating Fact**  
90% of germs on the hand are found under the nails!





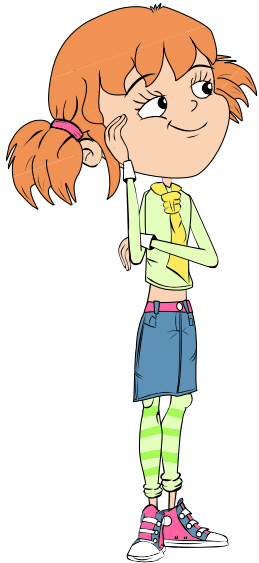
**Student 1**



**Student 2**



**Student 3**



**Student 4**



**Student 5**







## National Curriculum Links

### Key Stage 2

Sc1: 1a, 1b, 2a, 2b, 2c, 2d, 2e, 2f, 2g, 2h, 2i, 2j, 2k, 2l

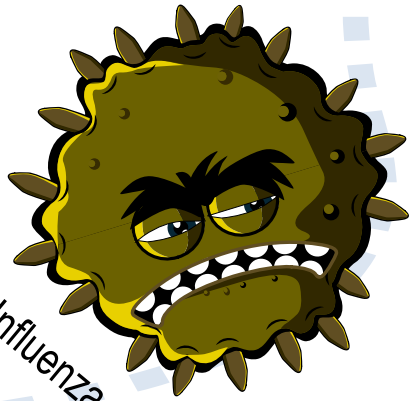
Sc2: 2g, 5f

### Unit of Study

Unit 6 – Micro-organisms

### Estimated Teaching Time

50 minutes



Influenza

## 2.2 Spread of Infection Respiratory Hygiene

The Spread of Infection section aims to teach students how poor hand hygiene, respiratory hygiene and improper care with food can lead to the spread of microbes and disease.

In 2.2 Respiratory Hygiene, students get to observe on a large and fun scale how far germs are carried when they sneeze. Through a set of trial experiments, students learn that covering their mouths with a tissue when they cough and sneeze helps prevent the spread of infection.

### Learning Outcomes

#### All students:

- Will learn that infection can spread through sneezing and coughing
- Will understand that covering the mouth when sneezing or coughing can prevent the spread of infection

#### More able students:

- Will know that coughing or sneezing in your hand can still spread infection





e-Bug

## 2.2 Spread of Infection

### Respiratory Hygiene

#### Key Words

Contagious  
Experiment  
Prediction  
Results  
Symptom  
Transmission

#### Materials Required Per Student

- A copy of [SW 1](#)

#### Per Group

- A sneezing runway
- Blue sneezer spray bottle
- Red sneezer spray bottle
- Green sneezer spray bottle
- Measuring tape
- Giant or gloved hand
- Giant tissue

#### Health and Safety

- Students may require aprons and gloves
- Ensure that the food colouring is **EXTREMELY** dilute
- Ensure that all spray bottles have been thoroughly cleaned and rinsed prior to use
- Students may need to wear safety goggles

#### Available Web Resources

- A demonstration of this activity

RESP  
TS 1

#### Background Information

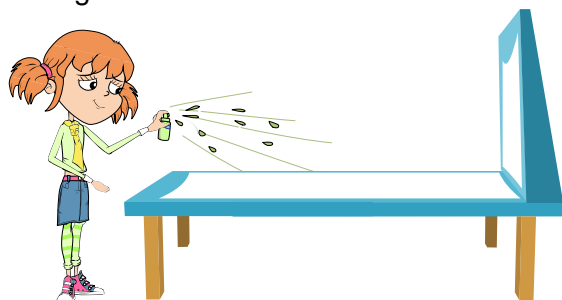
The most common mode of spreading infection is through aerosols, such as coughs and sneezes. They can also be spread via a more direct route, for example through human contact (touching, kissing, dirty hands, sharing toothbrushes, cups) and by eating contaminated food.

Colds and flu are the most common illnesses in the classroom and perhaps among the most contagious. Colds and flu are caused by viruses and, as such, cannot be cured by antibiotics. Generally bed rest and drinking plenty of fluids are recommended, however if symptoms persist then a visit to the local doctor is required. Symptoms of colds and flu include headache, sore throat and fever. Colds also cause runny noses! Many sore throats associated with colds and flu are due to the viruses in the throat making it feel raw, breathing in through the mouth causes the throat to feel dry and continual coughing causing an aching feeling.

Sneezing is a way in which our body tries to get rid of any harmful microbes and dust we might inhale. The harmful microbes and dust get caught on the nose hair and tickle our nose. The nose sends a message to the brain which then sends a message back to your nose, mouth, lungs and chest telling them to blow the irritation away. In the case of colds and flu, millions of virus particles rush out and contaminate the surface on which they land; this could be our food or hands.

#### Advance Preparation

1. Create a sneezing runway by placing 3 – 4 desks in a row with a vertical back board and covering them with white paper (lining wallpaper is a cheap alternative) as illustrated below.
2. Fill one spray bottle per group with water and food colouring. A different colour for each group makes the activity more exciting for the students.
3. Create a large cut out hand from cardboard for each group with a longer arm section for holding or alternatively cover a student's hand with a disposable glove.
4. Create a large tissue from a section of kitchen roll.





## 2.2 Spread of Infection Respiratory Hygiene

# Lesson Plan

### Introduction

1. Begin the lesson by telling the students that they are going to learn how harmful microbes can be passed from person to person by sneezing and coughing. Ask students what they think people mean when they say 'You gave me the cold' or 'I caught the flu from you'.
2. Explain to students that many diseases are airborne and are spread in tiny droplets of mucus and water coughed and sneezed into the air by people. Tell them that diseases spread in this way range from the common cold and flu, to rarer, more serious infections such as meningitis or tuberculosis (TB) which can make you very ill. The microbe images found on the website, [www.e-bug.eu](http://www.e-bug.eu), in section 1.1 may help students visualise these harmful microbes.
3. Continue to discuss the cold and flu, explaining that they are caused by viruses and not bacteria. Explain that it is very important for everyone's health that people cover their mouth and nose with a tissue when they cough and sneeze. There are sometimes large outbreaks of flu when 1000s of people in a country get the infection.
4. Ask students to try and remember the last time they had the cold or flu. Ask them to write down the names of everyone else they knew who had the cold and flu at the same time. Ask them to identify, if they can remember, who developed the symptoms first. Do they think they may have caught the cold or flu from these people?

### Main Activity

1. Divide the class into groups of 4 – 5 students
2. Each group should be provided with the sneezing runway, a sneezing bottle, a measuring tape or ruler, a giant hand or glove and a giant tissue. Provide each student with [SW 1](#). Ensure they have read and understood the instructions before starting the activity.
3. To demonstrate the distance a sneeze and microbes in the sneeze travel, students in each group should take turns holding the bottle at the end of the runway and simulate a sneeze by squeezing the trigger once over the paper. Before 'sneezing' (squeezing the trigger) students should predict how far and wide the sneeze will go and fill this in on their results sheet ([SW 1](#)). After 'sneezing' students should measure and record how far and how wide each student's sneeze spreads and fill this on their results sheet.
4. The next step is to observe what happens when we put our hand over our mouth when we sneeze; the microbes stay on our hands and can spread to anything we touch. One student in each group should be the 'sneezer' and the second student should hold the giant or gloved hand about 2 – 5cm away from the spray bottle. Students should fill both predicted and actual outcomes on their results sheet.
5. Finally, we want to observe what happens when we cover our mouth with a tissue during sneezing. Ask a different student in each group to be the 'sneezer' and ask another student to hold the tissue directly in front of the spray nozzle. Students in the group should fill in both predicted and actual outcomes on [SW 1](#) and draw a graph of the results.





## 2.2 Transfer of Infection Respiratory Hygiene

# Lesson Plan

### Plenary

1. Discuss with students the outcome of their results. Ask them to look at the hand and notice that the spray 'microbes' are still on it.
2. Show them that when they place the hand on the paper, sprayed side down, the microbes transfer to the paper. Explain that sneezing in your hand can spread the microbes to things that we touch, so it is better to sneeze into the tissue and then throw it away and wash your hands as soon as possible.
3. Discuss with students why some countries use the message 'sneeze in your sleeve'.

*As was observed from the activity, microbes can still be passed from person to person through touch if we cover our coughs and sneezes with our hands. The Centre for Disease Control (CDC) in the USA recommend that in the absence of a tissue we sneeze on our sleeve because we are less likely to transmit harmful microbes to other people by doing this.*

### Extension Activity

1. Students should create some simple rules or an easy message to reduce the spread of coughs, colds and flu in their school, for example:
  - Coughs and sneezes spread diseases
  - Cover your coughs and sneezes with a tissue
2. Transfer these messages to poster format, creating simple effective posters to place around the school or classroom.





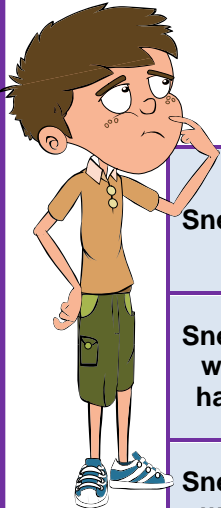
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# Super Sneezes



## My Observations

How far did your sneeze travel?



		Student 1	Student 2	Student 3	Student 4	Student 5
Sneeze	Length (cm)					
	Width (cm)					
Sneeze with hand	Length (cm)					
	Width (cm)					
Sneeze with tissue	Length (cm)					
	Width (cm)					

### Hand in front of sneeze

1. What did you think would happen when you put the hand over the mouth to sneeze?

\_\_\_\_\_

2. What actually happened? (Where and how far did the sneeze travel?)

\_\_\_\_\_

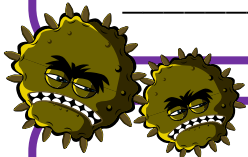
### Tissue in front of sneeze

3. What did you think would happen when you put the tissue over the mouth to sneeze?

\_\_\_\_\_

4. What actually happened? (Where and how far did the sneeze travel?)

\_\_\_\_\_



## My Conclusions

1. If we don't wash our hands after sneezing into them what might happen?

\_\_\_\_\_

2. What should we do with a tissue after sneezing into it?

\_\_\_\_\_

3. Which is best for preventing the spread of infection, sneezing into your hand or into a tissue? Why?

\_\_\_\_\_







## National Curriculum Links

### Key Stage 2

Sc1: 1a, 1b, 2a, 2b, 2c, 2d, 2e, 2f, 2g, 2h, 2i, 2j, 2k, 2l

Sc2: 2g, 5f

### Unit of Study

Unit 6 – Micro-organisms

### Estimated Teaching Time

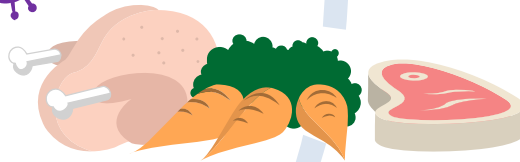
50 minutes

# 2.3 Spread of Infection Food Hygiene



The Spread of Infection section aims to teach students how poor hand hygiene, respiratory hygiene and improper care with food can lead to the spread of microbes and disease.

Section 2.3, Food Hygiene, teaches students how easily potentially harmful microbes on raw food can transfer to humans. Students act as chefs for the class and prepare a pretend chicken sandwich. In this activity students literally see how far they have spread harmful microbes!



### Learning Outcomes

#### All students will learn that:

- Microbes can be found on our food and can transfer to humans
- Cooking food properly can kill harmful microbes
- Bacteria multiply very quickly

#### More able students will learn that:

- Refrigeration only stops microbes growing, it doesn't kill them



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## 2.3 Spread of Infection Food Hygiene

### Key Words

Cross-contamination  
Micro-organism  
Pathogen

### Materials Required

#### Per Student

- A copy of [SW 1](#)
- A copy of [SW 2](#) OR [SW 3](#)

#### Per Group

- A copy of [SH 1](#)
- A copy of [SH 2](#)
- Glo Gel or powder
- UV lamp
- Chicken fillets made from play dough ( A recipe can be found in section 1.1)
- Crepe paper (green and red) or plastic toy food
- Paper plates
- Plastic knives
- Oven area

### Health and Safety

- Care must be taken not to ingest the Glo Gel
- Do not look directly into the UV light
- Take care with students who may have sensitive skin

### Alternative Suggestion

- Fine glitter or glitter hair gel may be used as an alternative to the Glo Gel. It is important that the glitter transfers easily from one source to another. Different coloured glitter may be used to represent different types of microbe.

- Cinnamon and oil may also be used.

### Background Information

Harmful microbes found in food can lead to food poisoning, which can be dangerous and can kill – though this is rare. The symptoms of food poisoning can last for days and include stomach pains, diarrhoea, vomiting, nausea and fever. The symptoms usually come on suddenly, but can occur several days after eating contaminated food. They will usually get better on their own.

Not all microbes associated with food are harmful, here are examples of some of the good, bad and ugly microbes associated with food.

**Useful Microbes** can be used to make food and drink, e.g. the yeast *Saccharomyces cerevisiae* is used to make bread and beer. *Lactobacilli* bacteria are used in yogurt and cheese making.

**Harmful Microbes** can cause food poisoning e.g. the bacteria *Salmonella*, *E. coli* and *Campylobacter* are commonly found on raw meats and can cause diarrhoea and vomiting in humans and sometimes even death.

**Food Spoilage Microbes** do not usually cause harm to humans. These are generally mould or bacteria, e.g. the fungus *Rhizopus stolonifer* causes bread mould and the bacterium *Pseudomonas* can cause the green discolouration on bacon and other meat.

### How can we prevent food poisoning and delay food spoilage?

Most microbes we find on food grow best between 5°C and 40°C in warm and damp places. They generally dislike places that are too warm and are killed at temperatures above 70°C. In cooler temperatures, below 5°C, most bacteria multiply very slowly, if at all. Some bacteria will die, but many survive and can start to multiply again if warm conditions return. This is why we keep our food in the fridge and cook our meat well before we eat it.

Sometimes harmful microbes found on food can spread to other foods, for example via hands, or kitchen utensils and cause illness when those foods are eaten. This is known as cross-contamination.

### Advance Preparation

1. Copy [SW 1](#) and [SW2](#) OR [SW 3](#) for each student.
2. Shape a chicken breast fillet out of playdough for each group and cover with the Glo gel or powder.
3. Establish an oven/microwave area for each group. This could be in the form of a toy oven or a sheet of A4 paper labelled oven.
4. Cut the crepe paper into strips to represent lettuce and tomatoes or purchase plastic toy food.





## 2.3 Spread of Infection Food Hygiene

# Lesson Plan

### Introduction

1. Explain to the students that some microbes like to grow in nice warm damp places, like inside our bodies, and when they find somewhere they like, they grow and multiply! But they don't like places that are very warm or cold. Tell the class that for this lesson they will be looking at how harmful microbes can enter our bodies through the food we eat!
2. Ask students if they know why we cook food or keep it in a fridge. Explain that putting food in the fridge only slows or stops microbial growth, it doesn't kill them. The microbes will grow again when they come out of the fridge. The only way to kill microbes is to cook food until it is really hot and cooked all the way through. This is because very warm temperatures kill many harmful microbes.
3. Discuss with the class which foods contain the most harmful bacteria. Show the class pictures of various food types ([SH 1](#)) and ask them which they think contain the useful/harmless bacteria and which contain the harmful.

### Answers

*Fruit and Vegetables:* Useful/Harmless – there are many microbes in soil which help crops grow but do not have any harmful effect on humans.

*Milk:* Useful microbes – fresh milk contains *Lactobacillus* bacteria which help us digest food.

*Yogurt:* Useful microbes – yogurt also contains *Lactobacillus* bacteria which help us digest food.

*Bread:* Useful/Harmless microbes – the yeast *Saccharomyces cerevisiae* helps bread to rise.

*Raw Chicken:* Harmful microbes – raw chicken may contain *Salmonella*, *E. coli* or *Campylobacter* bacteria all of which can cause food poisoning in humans.

*Raw Sausages:* Harmful microbes – raw meat may contain *Salmonella* or *E. coli* bacteria which can cause food poisoning in humans.

4. Show students how these foods should be stored in the fridge, i.e. meat on the bottom shelf. A web game to help students remember these points can be found at [www.e-bug.eu](http://www.e-bug.eu).

### Main Activity

1. This activity is for groups of 2 – 3 students. Tell the students that they will be making a pretend chicken sandwich. Show them their cooking area.
2. Before they start the activity, ask the students how they think they should prepare the chicken sandwich based on what they have learned in the class. They may wish to follow the guidelines in [SH 2](#).
3. When the task is complete ask each group how good they have been in keeping their kitchen clean. Explain to students that their 'raw chicken' was coated with a special gel that represents the harmful bacteria. They couldn't see the gel because in real life they wouldn't be able to see the harmful bacteria.
4. Shine the UV light on a test area of Glo Gel on your hand so the students can see how it works. Then go around each group and see how much harmful bacteria they spread around their kitchens and on the food they are about to eat.
5. Ask students what they should have done to ensure that the harmful bacteria did not go onto the sandwich or cooked ingredients, i.e. wash their hands and the benches after touching the raw chicken.





## 2.3 Spread of Infection Food Hygiene

# Lesson Plan

### Plenary

1. Provide students with handout **SW 1** to complete.
2. Check for understanding by asking students:
  - a. Why were there harmful bacteria all over the kitchen?  
*The harmful bacteria are spread all over the food preparation area by the student's hands because they didn't wash their hands after touching the raw meat.*
  - b. Why is it important to wash hands before and after cooking?  
*There may be harmful microbes on our hands and there are a lot of harmful bacteria on the surface of raw meat, many of which can cause food poisoning.*
  - c. How could we prevent the spread of the harmful bacteria?  
*There are many ways in which we can prevent the spread of harmful microbes when preparing food*
    - i. Wash hands on a regular basis when preparing food, especially after handling raw meat and before touching food which should be eaten raw, i.e. salad vegetables.
    - ii. Use separate chopping boards for raw meat, cooked meat, vegetables, bread, etc.
    - iii. Use separate knives for raw meat and cooked meat.
  - d. If someone ate the contaminated chicken sandwich what might happen?  
*They would probably get ill with food poisoning.*
  - e. Why are there usually no harmful bacteria on cooked chicken?  
*We cook chicken well to kill any harmful bacteria living there. The high cooking temperatures kill harmful bacteria.*
  - f. Why do we store food in a fridge?  
*The fridge is quite a cold environment (4°C). In cooler temperatures, below 5°C, most bacteria multiply very slowly, if at all. Some bacteria will die, but many survive and can start to multiply again if warm conditions return.*
3. Ask students if they were surprised at how many things they touched in their own kitchen when they made a sandwich. Remind them that if the food was contaminated with harmful microbes then they would have spread these harmful microbes all over their kitchen.

### Extension Activity

1. This activity can be carried out either individually or in groups of 2 – 4 students.
2. Provide students with **SW 3**.
3. Students should identify 9 ways in which the group are not being careful about spreading infection and provide a reason for each.



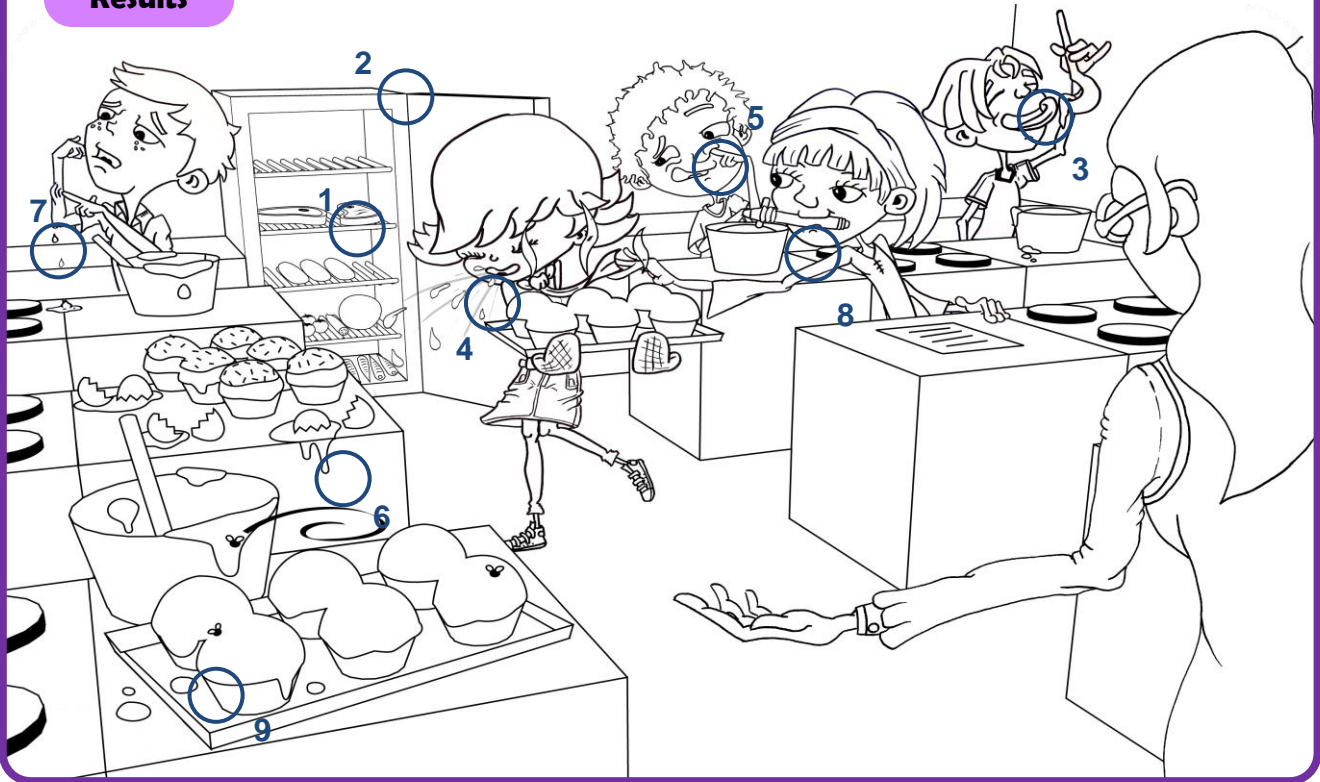


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## 2.3 Spread of Infection Food Hygiene

### Teacher Answer Sheet

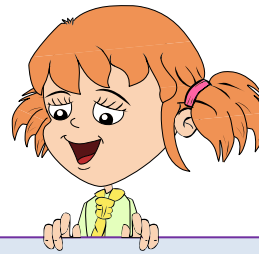
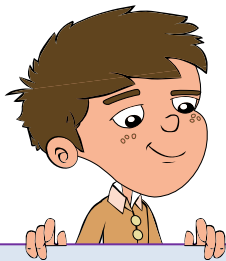
#### Results



#### Explanation of Results

1. Raw meat should be kept on the bottom shelf of the fridge or on a plate to prevent the blood and harmful microbes dripping onto and contaminating the other items in the fridge.
2. Normal fridge temperatures (2–5°C) stop microbes from growing and multiplying. Leaving the fridge door open heats up the fridge and allows the microbes to grow and multiply until there are enough to become dangerous.
3. Licking the spoon can spread any harmful microbes from the mouth into the food mixture or alternatively, any unwanted microbes in the raw mixture into the mouth.
4. Using a tissue to cover your mouth when coughing or sneezing helps prevent the spread of infection.
5. Hair and mucus on the inside of the nose trap any unwanted microbes we may breathe in. The 'snot' picked from the nose may contain many harmful microbes which can be spread onto our food or other people by our hands.
6. Raw eggs have been known to harbour harmful bacteria such as *Salmonella*, which could lead to a gut infection if ingested.
7. All cuts and spots should be covered when cooking, to stop microbes spreading from blood to food.
8. The pencil may have come into contact with harmful microbes around the room and putting it in the mouth can spread these microbes to the mouth or gut.
9. Flies are known to carry potentially harmful microbes from source to source.





**Which of the following foods have useful/harmless microbes and which have the harmful microbes?**



**Fruit and Vegetables**



**Milk**



**Yogurt**



**Bread**



**Chicken**



**Sausages**





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# How to make chicken sandwich



**Cut** the **chicken** into smaller pieces and put on a plate.



Put the **chicken** in the **oven** to cook.



Cut your **lettuce**, **tomatoes** and **cucumber** and begin to prepare your **sandwich**.



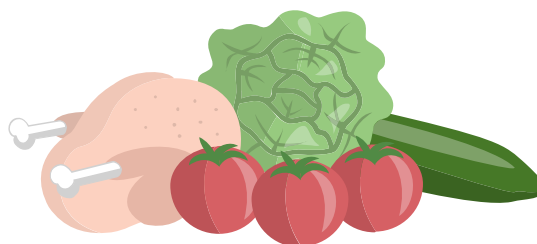
Prepare the **bread** for the sandwich and when ready take the **chicken** out of the **oven**.



**Layer** the sandwich with the salad ingredients and chicken and **serve** on plates.

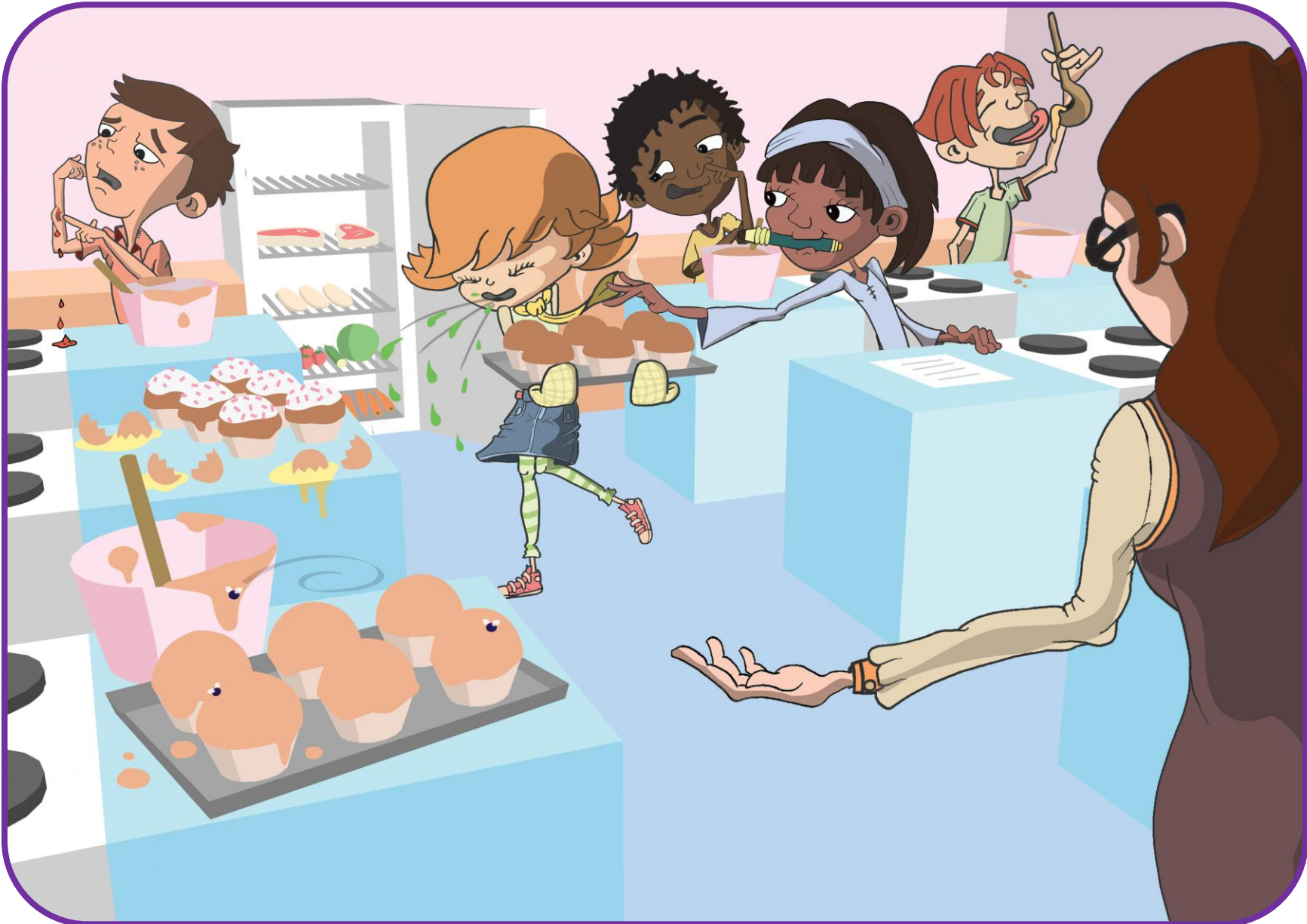


**Everyone** sit around their benches ready to **eat**.





Can you circle 9 things that the students in this cookery class should not be doing and why?



Can you circle 9 things that the students in this cookery class should not be doing and why?









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## 3.1 Prevention of Infection

### The Body's Natural Defences

#### Key Words

Antibodies  
Antigen  
Immune  
Inflammation  
Pathogen  
Phagocytes  
Phagocytosis  
Plasma  
White blood cells

#### Materials Required

- Download the presentation from [www.e-bug.org](http://www.e-bug.org)

#### Per student

- Copy of [SH 1](#)

#### Available Web Resources

- A MS PowerPoint presentation of [SH 1](#)
- An animation illustrating how the immune system functions

#### Background Information

Our body is extremely efficient at keeping us healthy. It has three major lines of defence:

##### 1. Stopping pathogens entering the body

Our skin is the first line of defence stopping many harmful microbes entering our body

The mucus and cilia (tiny hairs) in our nose trap any microbes and stop them entering our lungs

Even the tears in our eyes produce enzymes (although this is a chemical, not a physical barrier) which kill bacteria

##### 2. Non-specific White Blood Cells (WBC)

These WBCs are known as **phagocytes** and are non-specific because they will literally try to engulf and kill anything, they are not fussy! They engulf and digest foreign bodies by a process known as **phagocytosis**. They also trigger an **inflammatory response** by causing blood (makes the area red and hot) and **plasma** (makes the area swell up) to flow to the infected area. All this enables the right cells to get to the area and fight the infection.

##### 3. Specific White Blood Cells (WBC)

These WBCs are specific in that they target microbes only. All invading microbes have a unique molecule on their surface called an **antigen**. When these WBCs come across an antigen they don't recognise they start to produce proteins called **antibodies**. The antibodies then attach to the antigens marking them for destruction by other WBCs. The antibody will **ONLY** attach to the specific antigen for which it was created. Antibodies are created rapidly by the WBCs and flow around the blood attaching themselves to the invading microbe or **pathogen**. When all the pathogens are destroyed the antibodies stay in the blood ready to fight the disease should it return. In this way, the body maintains a memory of the disease making you **immune** to many diseases you have already had. If the pathogen attacks again the body is ready and quickly produces antibodies ready for attack.

#### Advance Preparation

1. Copy [SH 1](#) for each student.
2. Download the animation illustrating how the immune system works from [www.e-bug.eu](http://www.e-bug.eu).





# The Body's Defence System

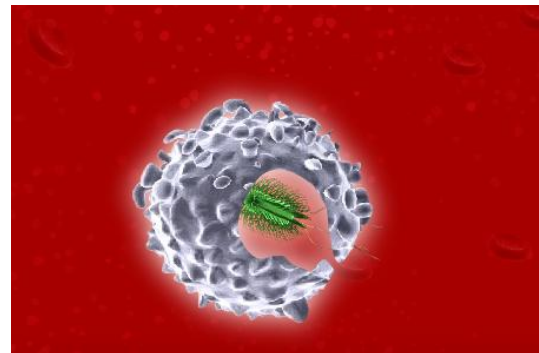
You don't always need medicine to help fight infection. Did you know your body works hard every day to fight harmful microbes without you even knowing it! The body has three lines of defence to stop microbes causing disease.

## First Line of Defence - Stops Microbes Entering the Body

1. The Skin  
The skin stops microbes entering the body unless it is cut or damaged. Even when damaged the blood clots quickly sealing the cut with a scab stopping microbes getting in.
2. The Respiratory System  
Mucus and tiny hairs in the nose stop microbes from entering the lungs.
3. The Eves

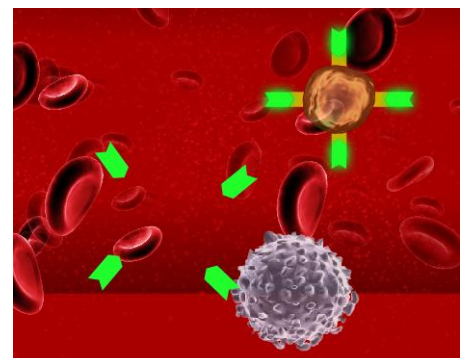
## Second Line of Defence - Non Specific White Blood Cells

1. White blood cells called phagocytes
  - a. These usually pick up anything 'foreign' that gets through the first line of defence
  - b. They engulf microbes and digest them
  - c. They are known as non-specific because they will attack ANYTHING that is foreign to the body
  - d. They also trigger swelling and redness by
    - i. Increasing blood flow to the area
    - ii. Cause fluid to leak into the damaged area



## Third Line of Defence - Specific White Blood Cells

1. Some produce Antibodies
  - a. All invading cells have distinctive markers called antigens on their surface
  - b. When specific white blood cells come across a foreign marker/antigen they produce antibodies which lock onto the invading cells marking them for destruction. These antibodies will ONLY target these specific markers/antigens and no others
  - c. Once the white blood cells know which antibodies to make, they produce them very quickly. These antibodies then either
    - i. Immediately start marking invading microbes for destruction
    - ii. Stay in the blood after the infection has gone so that they are ready to fight if the infection returns. This is why your body is immune to most diseases you have already had – it remembers how to make the antibodies quickly







## National Curriculum Links

### Key Stage 2

Sc1: 2a, 2b, 2f, 2h  
Sc2: 5a, 5f

### Unit of Study

Unit 6 – Micro-organisms

### Estimated Teaching Time

50 minutes

# 3.2 Prevention of Infection Vaccinations

Section 3.2, Vaccinations, explores how and who discovered vaccines.

In this is a student reading comprehension activity. Students are told a story about Edward Jenner and how he discovered vaccines. This story can either be given in individual student handouts or be read to the class by the teacher. 'Fill in the blanks' and 'answer questions' activities help reinforce the main points of the story.

The extension activity encourages students to recreate the story of Edward Jenner and his vaccine discovery through fun role play.



### Learning Outcomes

All students will learn that:

- Vaccines help prevent a range of infections, including the flu

More able students will understand that:

- There are not vaccines for all infection



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## 3.2 Prevention of Infection Vaccinations

### Key Words

Antibody  
Antigen  
Bacteria  
Disease  
Immune system  
Immunise  
Vaccination  
Vaccine  
Virus  
White blood cell (WBC)

### Materials Required Per Student

- Copy of [SW 1](#)
- Copy of [SH 1](#)
- A white board (not necessary)

### Available Web Resources

- A demonstration of this activity.

### FASCINATING FACT

The word vaccine comes from the Latin word vacca meaning cow, so named because the first vaccine was made from the milder cow pox disease.

### Background Information

Our immune system generally fights any harmful microbes that may enter our bodies. Getting plenty of rest, eating the correct foods and getting lots of sleep all help our immune system work properly hence preventing infection.

Another means of assisting our immune system is through **vaccinations**. Vaccines are used to prevent NOT treat infection. A **vaccine** is usually made from weak or inactive versions of the same microbes that make us ill. In some cases, the vaccines are made from organisms which are similar to, but not exactly, the microbes that make us ill.

When the vaccine is injected into the body the immune system attacks it as if the harmful microbes were attacking the body. The **white blood cells** create lots of **antibodies** to attach to specific markers on the surface, called **antigens**, of the vaccine organisms. Because the vaccine is an extremely weakened version of the microbe the WBC successfully eliminate all these cells and it will not make you ill. By successfully eliminating all the vaccine, the immune system remembers how to combat those microbes. The next time microbes carrying the same markers/antigen enter the body the immune system is ready to fight it before it has a chance to make you ill.

In some cases, the immune system needs reminding and this is why some vaccinations require booster jabs.

Some microbes like the flu, are tricky. They evolve so fast changing their markers/antigens. This means that the immune system can't remember how to fight them. For this reason, we have annual flu vaccinations.

### Advance Preparation

1. Copy of [SH 1](#) and [SW 1](#) for each student





## 3.2 Prevention of Infection Vaccinations

# Lesson Plan

### Introduction

1. Begin the lesson by explaining to the class that although there are many harmful microbes that can make us ill, in some cases, there are things we can do to prevent this happening.
2. Explain to the class that vaccinations are a harmless small amount of the microbe/disease markings/outer coat which teaches our body how to fight the bad microbe when or if we get attacked by the disease. Discuss with the class their experiences of vaccinations, which vaccinations they remember getting and when they got them.
3. Show the class images of the disease and bacteria/virus which they have been immunised against. (Available at [www.e-bug.eu](http://www.e-bug.eu)) Emphasise to the class that in the 1700s these diseases were extremely common.
4. Highlight to the class that without their vaccinations, many of the class would not have survived past 5 years of age. Explain that things like whooping cough, polio and TB are now extremely rare due to vaccinations.
5. Remind students that some microbes change their outer coats like we change our clothes. Some microbes change their markings/coats so quickly that scientists cannot create vaccines for many infections or they have to make a new vaccine every year, like the flu vaccine.

### Main Activity

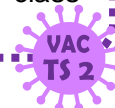
1. Provide each student with a copy of [SW 1](#).
2. Read the story of Edward Jenner ([SH 1](#)) to the class, either show the story to the class on the whiteboard or provide each student with a copy of [SH 1](#). The class can then read along with the story.
3. After reading the story, ask the class to fill in the spaces on their worksheet.
4. Students should also answer the questions at the bottom of the worksheet.

### Plenary

1. Check for understanding by asking students
  - a. What are vaccines?  
*Vaccines protect a person against a particular disease. They are dead or severely weakened versions of the microbe.*
  - b. When should vaccines be used?  
*Vaccines should be administered before an illness occurs, vaccines are a preventative measure.*
  - c. Who discovered vaccines?  
*Edward Jenner discovered vaccines in 1796.*

### Extension Activity

After reading the story of Edward Jenner, students should recreate the story into a play to present to the class. An example script can be found in [SH 2](#) which was written and performed by class 12 at Elmbridge Junior School. This play can be viewed at [www.e-bug.eu](http://www.e-bug.eu).



# Historic Heroes



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Edward Jenner was born in 1749. As a young boy, Edward enjoyed science and nature spending hours on the banks of the River Severn looking for fossils. In 1770, at the age of twenty one, he began training as a doctor in London. Two years later Edward began to practise as a doctor in his home town of Berkeley, Gloucestershire.



During this time, people were terrified of a horrible disease called smallpox. People who got this disease got severe scarring and sometimes even died! As a doctor, Edward Jenner listened to what the country people said about smallpox. They believed that someone who caught a different mild infection called cowpox from their cows would not catch the much more serious smallpox.




Jenner decided to carry out an experiment to see if the people were right. In 1796 a milk maid called Sarah Nelmes came to Jenner complaining of a cowpox rash on her hand. Jenner took some of the pus from the cowpox rash on Sarah's hand. He scratched some of the pus into the hand of an 8 year old boy called James Phipps, the son of his gardener. James fell ill with cowpox but soon recovered.



Jenner then took some pus from someone with the dangerous disease, smallpox, and scratched this into James' arm. James developed a scab but did not develop smallpox, Jenner guessed correctly. Jenner's discovery came to be known as vaccination from the Latin word for a cow: vacca. Jenner went on to vaccinate all the local children with the cowpox to stop them from getting the more dangerous smallpox disease.







# The discovery of vaccinations script

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## Scene 1 - by a river

<b>Narrator</b>	Edward Jenner was born in 1749. As a young boy Edward enjoyed science and nature, spending hours on the banks of the river Severn looking for fossils.
<b>Jenner</b>	What a lovely day to go looking for fossils on the bank of the river Severn. What could be more perfect!
<b>Narrator</b>	In 1770, at the age of 21, he began training as a doctor in London. Two years later Edward began to practice as a doctor in his home town of Berkeley, Gloucestershire. At this time smallpox and cowpox were a problem!

## Scene 2 - Dr Jenner's office

<b>Jenner</b>	Oh come in come in, what seems to be the problem Mr and Mrs Smith?
<b>Mrs Smith</b>	Well Dr Jenner, my husband has got himself a cowpox rash. What can be done for him?
<b>Mr Smith</b>	Also doctor, a friend of mine died last year from smallpox. But he never had cowpox.
<b>Jenner</b>	Yes, do go on Mr Smith.
<b>Mr Smith</b>	Well, I know lots of other people who have had cowpox but then never got smallpox. Do you think this means I won't get it doctor?
<b>Jenner</b>	You know Mr Smith, you are not the first patient to say that to me. I have my suspicions that you are correct. I will investigate the matter.
<b>Narrator</b>	And the good doctor did just that. When milk maid Sarah Nelmes came to Dr Jenner with a cowpox rash he took the opportunity to experiment with the help of an 8 year old boy, James Phipps.

## Scene 3 - Dr Jenner's office

<b>Sarah</b>	Doctor, I've got a cowpox rash on my hand.
<b>Jenner</b>	OK Miss Nelmes, let me take a look at that. Right young James, come here please and hold out your hand.
<b>Sarah</b>	What are you doing doctor?
<b>Jenner</b>	An experiment Miss Nelmes. I shall take some of the pus from your rash and scratch it into James' hand.
<b>Narrator</b>	James fell ill with cowpox but soon recovered. Dr Jenner was ready for part 2 of his experiment. It was now that the doctor scratched some pus from someone with smallpox into James' arm.
<b>Jenner</b>	James my boy, if all goes to plan your name will go down in medical history!
<b>James</b>	But what if it doesn't go to plan Dr Jenner?
<b>Jenner</b>	I won't lie to you James, you might well die!
<b>James</b>	(Gulps) Oh!
<b>Narrator</b>	But James didn't die. Jenner had guessed correctly and in time his discovery came to be known as vaccination. He then went on to vaccinate all the local children with cowpox to stop them getting smallpox. Even today his work is still recognized and Gloucestershire Royal Hospital have a unit named after him.



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# The story of Edward Jenner

## Reading Comprehension



Can you fill in the blanks in the story from the words in the box below?

Edward Jenner was born in \_\_\_\_\_, England. As a young boy Jenner's favorite subject was \_\_\_\_\_ and when he grew up he became a \_\_\_\_\_. At the time the people of England were terrified of a deadly disease called \_\_\_\_\_. Symptoms included severe \_\_\_\_\_ and many people died. Jenner noticed that milkmaids who caught the harmless infection \_\_\_\_\_, from their milking cows did not die from smallpox. Jenner took pus from the hand of a \_\_\_\_\_ who had cow pox and infected a boy called \_\_\_\_\_. The boy got infected with cowpox but soon recovered. Jenner then \_\_\_\_\_ James with smallpox. A \_\_\_\_\_ developed but the boy did not develop smallpox. Jenner was delighted that his idea was correct, he went on to \_\_\_\_\_ all the children in his town with cowpox to stop them getting smallpox.

### A Historic Hero

Dr Edward Jenner is one of the most important people in scientific history. Without his discovery of vaccinations more than half your class would not be here today!

Cowpox	James Phipps	Smallpox	Gloucestershire
Doctor	Milk-maid	Science	Scarring
Infected	Scab	Vaccinate	

## Understanding



Answer the following questions:

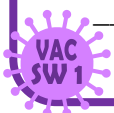
1. What was the name of the doctor who discovered vaccinations?  
\_\_\_\_\_
2. What was the name of the deadly disease at the time?  
\_\_\_\_\_
3. What was Jenner's idea to stop the deadly disease?  
\_\_\_\_\_
4. What happened to James after he was infected with the cowpox?  
\_\_\_\_\_
5. What happened to James after he was infected with the smallpox?  
\_\_\_\_\_
6. Why was it important for Jenner to test his idea on James before treating lots of children?  
\_\_\_\_\_

### Did you know?

By the age of 9, each child may have had at least 9 injections to prevent 10 different dangerous infections.

### Fascinating Fact

Vaccination comes from the Latin word for a cow – vacca.







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### Key Words

Antibiotic  
Disease  
Illness  
Immune system  
Infection  
Medicine  
Natural barriers  
Natural defence  
Symptom  
Vaccine

### Materials Required

#### Per Student/Group

- A copy of [SH 1](#)
- A copy of [SH 2](#)
- A copy, whiteboard or overhead projector (optional) of [SW 1](#)

## 4.1 Treatment of Infection Antibiotic Use and Medicine

### Background Information

The body has many **natural defences** to help fight against bad microbes that can cause infection, for example, the skin stops microbes entering the body, the nose has a sticky membrane trapping microbes if they are inhaled, tears contain substances which kill bacteria and the stomach produces acid which can kill many microbes if ingested. Generally, by living a healthy life (eating the right food, drinking plenty of water and getting lots of rest) these natural barriers help keep us healthy. However, in some cases, microbes can cross these barriers and enter our bodies.

The majority of the time the immune system defeats any harmful microbes entering the body, however in some cases the immune system needs help. **Antibiotics** are special medicines used by doctors to kill harmful **bacteria**. Some antibiotics stop the bacteria reproducing and others kill the bacteria. Antibiotics treat diseases caused by bacteria, such as meningitis, tuberculosis and pneumonia. They do **not** harm viruses, so antibiotics cannot treat diseases such as colds and flu, which are caused by viruses.

Before antibiotics were invented harmful bacteria killed many people. Today however, most bacterial infections are easily treated with antibiotics - but the bacteria are fighting back! Through increased exposure to the antibiotics the bacteria are becoming resistant to them. This means that bacterial infections are once again becoming life threatening. We can help prevent this from happening through a number of ways:

- only use antibiotics prescribed by your doctor
- always finish the course once prescribed
- don't use antibiotics for simple coughs and colds

Antiviral and antifungal medications are also available; however it is important that these are administered by a doctor. Much of the over the counter medication available is to alleviate the symptoms of many infections, for example, pain killers or medication to reduce the temperature associated with fever.

### Advance Preparation

Print/Photocopy [SH 1](#), [SH 2](#) and [SW 1](#) for each student.





## 4.1 Treatment of Infection Antibiotic Use and Medicine

# Lesson Plan

### Introduction

1. Begin the lesson by explaining to the students that now they are going to learn how to treat current infections. Remind students that harmful microbes make us ill. Ask students about their own experiences of being ill, what was the illness, how did they feel and what treatment did they receive? Did they go to the doctor or did they get something from the chemist?
2. Tell students that before we get medicine we should try and let our bodies fight the harmful microbes. Explain that inside our bodies we have an immune system that fights harmful microbes. If we get plenty of sleep and eat properly we keep our immune system strong and it keeps fighting the harmful microbes.
3. Explain however, that sometimes, if a lot of harmful microbes get into the body, the immune system may need help. This is when we need medicine. Explain that different types of medicine are used to treat the symptoms of different infections e.g. cough remedies, painkillers, medicines to bring down temperatures, etc.
4. Highlight to students that **antibiotics** are special medicines that are used to treat only **bacterial** infections. Antibiotics make us better by killing the harmful bacteria that make us ill. Explain to students that different antibiotics kill different bacteria therefore we should not use other people's antibiotics because they might not work; we should only take antibiotics given to us by the doctor.
5. Explain that if we do get antibiotics from the doctor then it is important to finish the course. If not, we may not kill all the harmful bacteria and they could make us ill again or become resistant.
6. Students should know that many of the other medicines e.g. pain killers or cough mixtures are used to relieve the symptoms of infection such as headaches, fever, congestion, etc.

### Main Activity

1. This activity can be carried out in small groups or as a classroom discussion. The task is presented like a cartoon story.
2. Each section of the cartoon has a situation with a decision that needs to be taken. The words spoken by the decision maker are in italics to highlight them.
3. Show each box to the students (either all together [SH 1](#) and [SH 2](#) or as individual boxes on the white board or overhead projector from the web [www.e-bug.eu](http://www.e-bug.eu)) and discuss whether the decision maker has made the right or wrong choice.
4. Discussion points can be found in [TS 3](#).







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## 4.1 Treatment of Infection Antibiotic Use and Medicine

### Discussion Points



Natasha should cover her mouth whilst coughing. Infection can easily spread from person to person through coughing and sneezing. A sneeze travels at approximately 100mph and at high force meaning that the microbes carried in a sneeze can travel very far and infect other people.



You should always wash your hands after going to the toilet. Many bad microbes that make you ill are found in toilets. Good personal hygiene is essential to a healthy lifestyle and can greatly reduce the spread of infection. Trials show that proper hand washing reduces absenteeism in schools, not just from tummy bugs but from coughs and colds too.



Amy should NOT use her sister's antibiotics. There are many different types of antibiotics which treat different bacterial infections. Doctors prescribe specific antibiotics for specific illnesses and at a dose suitable for the patient. Taking someone else's antibiotics may mean your infection does not get better.



Mrs Warren should have washed Harry's cut knee to clean any dirt or microbes which may have been present. Antiseptic cream applied to deeper cuts can also help prevent infection. There is generally no need to cover smaller cuts and grazes with a band aid, fresh air will help the scabbing process.



The doctor is right; antibiotics only work on bacterial infections. Coughs and colds are caused by viruses and in many cases the body's own natural defences will fight these infections. Other medicines from the chemists help with the symptoms of coughs and colds.



It is important for Harry to finish the course of antibiotics. Not finishing the course could result in the bacteria not being killed properly and becoming resistant to the antibiotic in the future.



1. Amy went to school not feeling very well. She had a headache and a runny nose. When she arrived in the classroom she took a seat beside Natasha. She soon realised that Natasha was also not well.



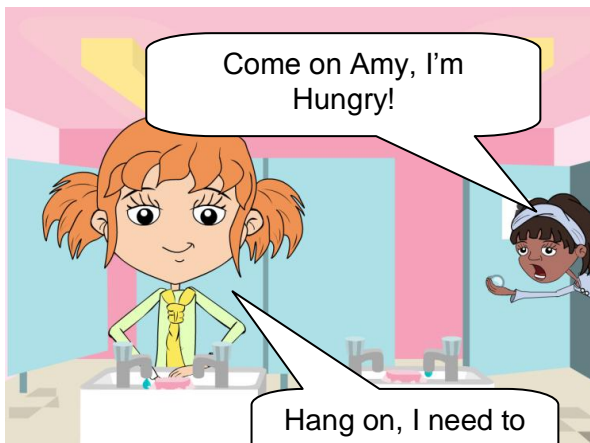
Are you OK Natasha?

Not really but my mum said that I have to come to school \*cough\* \*cough\*



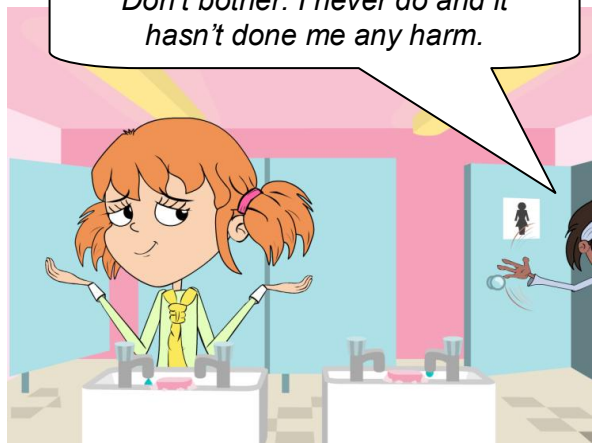
Mine too. But I'm not coughing. You really should cover your mouth you know.

2. At lunch time, Amy and Natasha went to the toilet. Natasha was hungry and in a hurry to have her lunch.



Come on Amy, I'm Hungry!

Hang on, I need to wash my hands.



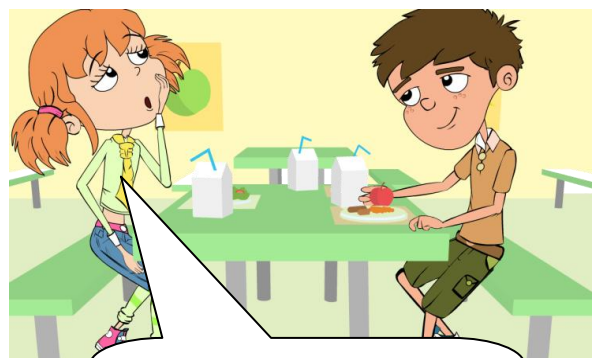
Don't bother. I never do and it hasn't done me any harm.

3. During lunch Amy was talking to her friend Harry about her headache and runny nose.



It really hurts and I think I'm getting a cough.

Don't you have any antibiotics at home you can take?



That's a good idea. We still have some from when my sister had an ear infection. I'll ask my mum.







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4. After they had eaten, the children went out to play. Harry fell over and cut his knee very deeply.



Owww my knee is bleeding.

Come on, let's take you to see Mrs Warren.



Oh dear. Let me see. It's not too bad. Let's just put a band aid on it.

5. When Amy got home, her mother decided to take her to the doctor. He said that she had a bad cold.

Go home and get some bed rest, take some painkillers for the headache if you need to.



But she's ill, you have to give her some antibiotics.

I'm sorry, but there's no need.



6. Harry didn't come to school the next day so Amy called around to see him on her way home from school.

You weren't in school today, are you OK?



No, my knee started to get really painful in the night so my Mum took me to see the doctor. He said that my cut got infected.

Oh no, did he give you painkillers?



No, he gave me antibiotics to help fight the infection but told me to take them until they were all finished.





# Word mix up!



**Antibiotic**

**Bacteria**

**Infection**

**Medicine**

**Painkiller**

**Virus**

**Symptom**

THE SMALLEST OF THE MICROBES - USUALLY HARMFUL

A DRUG USED TO TREAT A DISEASE OR INJURY

A SIGN OF ILLNESS  
E.G. HEADACHE,  
DIARRHOEA AND  
FEVER

SPECIAL MEDICINE  
USED TO TREAT  
BACTERIAL  
INFECTIONS

A DISEASE CAUSED BY  
A MICROBE

VERY SMALL MICROBE  
THAT CAN BE HELPFUL  
OR HARMFUL

A DRUG USED TO TAKE  
AWAY PAIN





# Word Glossary

<b>Antibacterial soap</b>	A soap that kills some bacteria. Antibacterial soaps are being increasingly marketed but they have no added value over soap in the school setting.
<b>Antibiotic</b>	A type of medicine which is used to destroy or prevent the growth of bacteria.
<b>Antibody</b>	A protein produced by white blood cells which binds to the microbe it recognises making the microbes easier to destroy by the white blood cells.
<b>Antigen</b>	A special marker or part of a microbe that when introduced into the body stimulates the production of an antibody by white blood cells.
<b>Bacteria</b>	Microscopic single celled microbe that can be beneficial or harmful to humans.
<b>Bug</b>	Another word for a microbe.
<b>Cell</b>	The smallest structural unit of an organism that is capable of working independently.
<b>Colony</b>	A group of microbes grown from a single parent cell.
<b>Colonise</b>	Ability to survive and grow on humans without necessarily causing harm.
<b>Contagious</b>	Able to be spread to others through direct or indirect contact.
<b>Contamination</b>	Impurity or uncleanness when an area or thing is covered with microbes.
<b>Cross Contamination</b>	Cross-contamination is the transfer of harmful microbes from one item of food to another via a non food surface such as human hands, equipment, or utensils. It may also be a direct transfer from a raw to a cooked food item.
<b>Culture</b>	The growth of microbes in a specially prepared growth medium.
<b>Dermatophytes</b>	A group of fungi that like to grow in or on the skin and scalp.
<b>Disease</b>	An illness that has a group of signs or symptoms.
<b>Experiment</b>	A test carried out to observe whether or not an idea or theory is true.
<b>Fermentation</b>	A process by which microbes break down complex sugars into simple compounds such as carbon dioxide and alcohol.
<b>Fungi</b>	The largest of the microbes. Unlike bacteria or viruses, fungi are multi cellular.
<b>Germs</b>	Another word for harmful or pathogenic microbes.
<b>Hygiene</b>	Conditions and practices that serve to promote and preserve health and reduce spread of infection.
<b>Illness</b>	Poor health resulting from disease.



# Word Glossary

<b>Immune system</b>	The collection of organs, tissues, cells, and cell products such as antibodies that helps to remove microbes or substances from the body.
<b>Immunise</b>	Perform vaccinations or produce immunity by inoculation of a substance that is similar to part of the microbe you want to protect against.
<b>Incubate</b>	To maintain at the best temperature and conditions for growth and development.
<b>Infection</b>	A disease caused by a microbe.
<b>Infectious</b>	Capable of causing an infection. A person, animal or thing that can pass microbes on.
<b>Inflammation</b>	A protective attempt by the body to remove the microbe or unknown substance as well as initiate the healing process for the tissue.
<b>Medicine</b>	A substance, used to treat disease or injury.
<b>Microbe</b>	A shortened form of 'micro-organism'.
<b>Micro-organism</b>	Living organisms that are too small to be seen with the naked eye.
<b>Microscope</b>	An optical instrument that uses a lens or a combination of lenses to produce magnified images of small objects, especially of objects too small to be seen by the unaided eye.
<b>Natural Barrier</b>	The body's natural barriers to infection include the skin, sticky substances in the nose and nasal hair, various enzymes produced in the body and stomach acid.
<b>Natural Defence</b>	The way the body protects itself from illness such as a rise in body temperature during infection to make the body inhospitable to invading microbes and the creation of antibodies in response to microbial invasion.
<b>Pathogen</b>	A microbe that can cause an illness.
<b>Phagocytes</b>	White blood cells which attack any foreign objects which enter the blood stream.
<b>Phagocytosis</b>	The method by which phagocytes engulf and digest unwanted microbes.
<b>Plasma</b>	The yellow coloured liquid of the blood in which the blood cells are suspended.
<b>Prediction</b>	An educated guess about future events.
<b>Probiotic</b>	Literally means 'for life'. Probiotics are bacteria that aid human digestion.
<b>Results</b>	The outcome or effect of an experiment.
<b>Symptom</b>	A sign of illness, e.g. headaches, fever and diarrhoea.



# Word Glossary

<b>Toxin</b>	A harmful substance produced by some harmful microbes.
<b>Transfer</b>	To move from one place to another. Spread of a microbe.
<b>Transmission</b>	Movement from one place to another.
<b>Virus</b>	The smallest of the microbes, viruses cannot survive on their own and need to live in the nucleus of other living organisms.
<b>Vaccination</b>	Inoculation with a vaccine in order to protect against a particular infection.
<b>Vaccine</b>	A weakened or killed microbe, such as a bacterium or virus, or of a portion of the microbe's structure that when injected into a person leads to antibody production against the microbe. The vaccine cannot cause infection itself.
<b>White blood cell (WBC)</b>	Cells found in the blood which help protect the body against infection and disease.



**This project has been led by the Primary Care Unit, Health Protection Agency with assistance from the following schools:**

### **Junior Schools**

**Brimscombe Church of England Primary School, Gloucestershire**  
**Clearwell Church of England Primary School, Gloucestershire**  
**Cirencester Junior School, Gloucestershire**  
**Elmbridge Junior School, Gloucestershire**  
**Latymer Prep School, London**  
**Mere School, Gloucestershire**  
**Nailsworth Junior School, Gloucestershire**  
**Powell's Junior School, Gloucestershire**  
**Stow on the Wold Junior School, Gloucestershire**  
**Swell Church of England Primary School, Gloucestershire**  
**Siddington Church of England Primary School, Gloucestershire**  
**Uplands Community Primary School, Stroud**

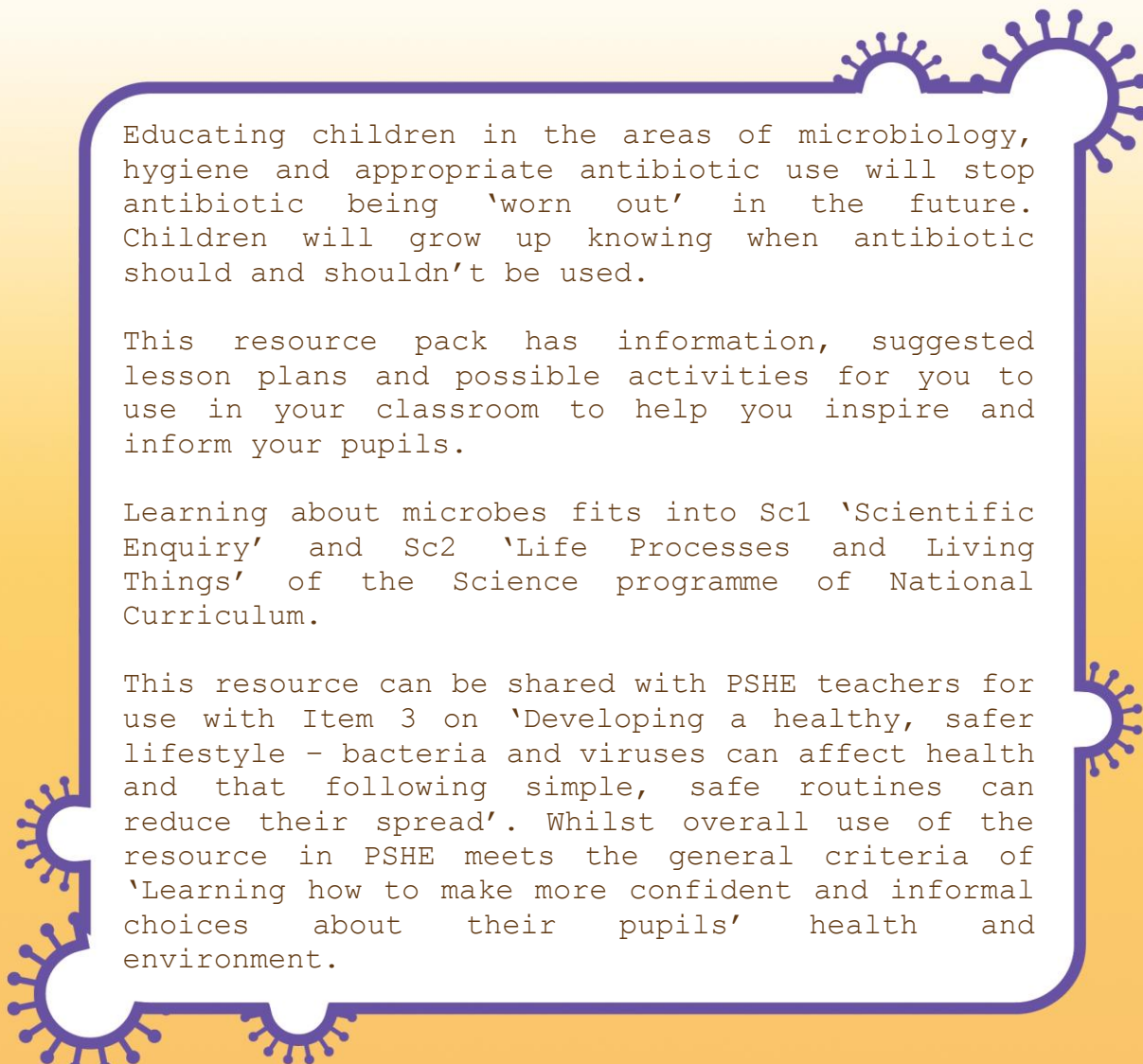
### **Senior Schools**

**Barnwood Park Arts College, Gloucestershire**  
**Bishops College, Gloucestershire**  
**Chipping Sodbury School, Bristol**  
**The Cotswold School, Gloucestershire**  
**Deerpark School, Gloucestershire**  
**Hayesfield School, Bath**  
**Heywood Community School, Gloucestershire**  
**Kingsfield School, Bristol**  
**Lakers School, Gloucestershire**  
**Ralph Allen School, Bath**  
**Ribston Hall High School, Gloucestershire**  
**The Ridings High School, Bristol**  
**Smithycroft Secondary School, Glasgow**  
**Thorntree Primary School, Glasgow**  
**Trinity Catholic School, London**

**The resource has been produced in collaboration with the following bodies:**

**City University, London**  
**International Scientific Forum on Home Hygiene**  
**The Society for General Microbiology**  
**The Department of Health**

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A decorative border in a dark purple color, featuring stylized, spiky shapes resembling microorganisms or cells. The border is irregular, with several circular and semi-circular protrusions and indentations, some of which have small spikes radiating from them. It frames the central text area.

Educating children in the areas of microbiology, hygiene and appropriate antibiotic use will stop antibiotic being 'worn out' in the future. Children will grow up knowing when antibiotic should and shouldn't be used.

This resource pack has information, suggested lesson plans and possible activities for you to use in your classroom to help you inspire and inform your pupils.

Learning about microbes fits into Sc1 'Scientific Enquiry' and Sc2 'Life Processes and Living Things' of the Science programme of National Curriculum.

This resource can be shared with PSHE teachers for use with Item 3 on 'Developing a healthy, safer lifestyle - bacteria and viruses can affect health and that following simple, safe routines can reduce their spread'. Whilst overall use of the resource in PSHE meets the general criteria of 'Learning how to make more confident and informal choices about their pupils' health and environment.