e-Bug

www.e-bug.eu

department for children, schools and families

P2-P7/Science Primary School
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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 (P2-P7 and S1-S3) 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 or e-mail us at 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
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.
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
1.1 Micro-organisms

An Introduction

**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

**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

**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 for student viewing.

**Fascinating Fact**

Antonie van Leeuwenhoek 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’.
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), 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. 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.
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

1. Mix together the dry ingredients

2. Add the water and mix until smooth

3. Add the food colouring followed by the oil

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

5. 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

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## 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.

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### 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.

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### Fungi

**Penicillium**

- 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!
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!
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

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!

Draw your microbe here

My Observations

1. Is it a beneficial or harmful microbe?

_________________________

2. Choose a name for your microbe.

_________________________

Fascinating Fact

YOU are home to 1000 million microbes!

This is a picture of my ____________________________
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:

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:

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:

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:

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
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

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 thermophilous 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.

Available Web Resources

- A demonstration of this activity
- An alternative ‘yogurt making’ 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. 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 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.
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
1. Follow the instructions in the Yeast Races Recipe.

### Yeast Races

#### Procedure

1. Follow the instructions in the Yeast Races Recipe.

#### My Results

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#### Did you know?

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

#### Fascinating Fact

There are trillions friendly bacteria in the average human gut.

#### 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?
   
   ________________________________
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
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.

**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

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

DOWN
2. I make your eyes swollen and itchy. I am not caused by a microbe. I am caused by flower pollen.
3. How you feel when your body is fighting infection.
5. 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).
8. I am often seen on teenagers faces. I am caused by microbes on the skin.
10. 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.
11. Watch out! Bad tummy microbes can sometimes take you by surprise and make you do this.
Harmful Microbes
Micro-organisms

Harmful Microbes
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).
ACROSS
1. I make you do this when you have a cold to spread microbes by causing a tickle in your throat.
4. I am a viral disease that can give you swollen itchy red spots all over your body.
6. I am a part of your body and spread microbes from person to person. Washing me gets rid of bad microbes.
7. I am a viral disease that will make you hot and sweaty.
9. You will get me if you don’t cook your meat properly or wash your hands after handling raw meat.
12. 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!
13. I am another word for a pain in your head.

DOWN
2. I make your eyes swollen and itchy. I am not caused by a microbe. I am caused by flower pollen.
3. How you feel when your body is fighting infection.
5. 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!
8. I am often seen on teenager’s faces. I am sometimes caused by microbes on the skin.
10. 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.
11. 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
DIRTY HANDS
FOOD POISONING
SLEEPY
VOMIT
SPOT
COUGH
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 method is best for hand washing.

**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
### 2.1 Spread of Infection

#### Hand Hygiene

**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’

**Available Web Resources**

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

**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.

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**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

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**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.**
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.
How clean are your hands?
**Procedure**

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

**My Observations**

<table>
<thead>
<tr>
<th>After washing (or not washing) and shaking hands</th>
<th>Student 1</th>
<th>Student 2</th>
<th>Student 3</th>
<th>Student 4</th>
<th>Student 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>No wash (control)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cold Water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warm Water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warm Water and Soap</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. On the next page draw where you saw microbes after hand washing and shaking, for your group only.

2. The method of hand washing (not control) that **removed most** microbes from the lead person was:
   - Cold Water
   - Warm Water
   - Warm Water and Soap

3. The method of hand washing (not control) that **removed fewest** microbes from the lead person was:
   - Cold Water
   - Warm Water
   - Warm Water and Soap

4. The method of hand washing which **spread the most** microbes along the line was:
   - Cold Water
   - Warm Water
   - Warm Water and Soap

5. The method of hand washing which **spread the fewest** microbes along the line was?
   - Cold Water
   - Warm Water
   - Warm Water and Soap

6. Draw a graph of how far the microbes spread for all four groups (including control).

**My Conclusions**

1. What is the best way of getting rid of microbes from our hands?
   ________________________________________________________________

2. What difference does using soap make?
   ________________________________________________________________

3. When should we wash our hands?
   ________________________________________________________________

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**Fascinating Fact**

90% of germs on the hand are found under the nails!
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
**2.2 Spread of Infection**

**Respiratory Hygiene**

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**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

---

**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.

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**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.

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**Available Web Resources**
- A demonstration of this activity

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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’.

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, in section 1.1 may help students visualise these harmful microbes.

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.

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?

Divide the class into groups of 4 – 5 students

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.

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.

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.

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.

Plenary

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.
My Observations
How far did your sneeze travel?

<table>
<thead>
<tr>
<th>Sneeze</th>
<th>Length (cm)</th>
<th>Width (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>with hand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>with tissue</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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?
__________________________________________________________________________________
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
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. They can also be spread if raw meats are washed and microbes splash onto work surfaces or other foods. This is known as cross-contamination.

**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.

**Advance Preparation**
1. Copy SW 1 and SW 2 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.
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 and Harmful – Most of the microbes found on fruit and vegetables are harmless but sometimes harmful microbes can be found in the soil in which they are grown. It is therefore important to wash all fruit and vegetables before eating.

*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.
      iv. Raw meats should not be washed to avoid harmful microbes splashing onto other foods and surfaces
   
   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.
2.3 Spread of Infection

Food Hygiene

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
How to make chicken sandwich

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

2. Put the chicken in the oven to cook.

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

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

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

6. Everyone sit around their benches ready to eat.
Always wash hands after handling raw meats.

My Observations
After preparing the sandwich this is where I saw the bacteria:

- On the sandwich
- On the chicken
- On the preparation area
- On my hands
- Other places

What about YOUR Kitchen?
1. Imagine all the bacteria on your hand are painted blue and you will leave a blue mark every time you touch something.

2. In the box provided draw a plan of your kitchen. Make a blue mark on everything you would touch to make a sandwich.

My Conclusions
1. If we don’t wash our hands after touching the raw chicken what could happen?
   ____________________________________________

2. How can we stop the microbes from the raw chicken spreading to other areas?
   ____________________________________________

3. If someone ate the sandwich with the microbes on it, what might happen?
   ____________________________________________

Never wash raw meat as this could splash harmful microbes onto other foods.
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?
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 2.4, Farm Hygiene, teaches students that the farm environment is home to both useful and harmful microbes. Students learn through group discussion, ‘social networking’, and a farm journey board game, the risks and benefits of various farm microbes.

Learning Outcomes

All students will learn that:
- Useful microbes on the farm help the farmer with food production
- Harmful microbes can be found on the farm and that these microbes can spread to humans
- By washing our hands and following some basic rules we can reduce the chance of picking up an infection on the farm

More able students will learn:
- Where specific harmful microbes can be found on the farm
- Where specific useful microbes can be found on the farm and how they are used in food production
2.4 Spread of Infection
Farm Hygiene

The farm environment is a place of fun and education for people of all ages. It is essential however, to be aware of the microbes associated with the farm environment, some of which can be harmful to humans, to ensure that farm visits are enjoyable and safe. Farm animals, even those that appear clean and healthy, may carry microbes that are useful and harmless to the animal, but can make us very ill if they get inside our body. *Escherichia coli*, *Salmonella* and *Campylobacter* are examples of some of the bacteria that can be a cause of infection for all ages, but the symptoms can be particularly serious for young children. These bacteria are normally carried in the animal droppings and as such, may be present anywhere faeces can be found, for example on gates, fences, on the animals face, etc. N.B. it only takes a small number of these bacteria to cause an infection.

Symptoms of each microbial infection can vary but generally include rapid fluid loss from diarrhoea and vomiting and can lead to death in very severe cases.

However there are many more useful microbes on the farm than harmful microbes. These include *Lactobacilli* that ferment silage and turn milk into yogurt; thermophiles that break down decaying plant matter in compost; and *rhizobia* that change atmospheric nitrogen gas into ammonia in the soil. This lesson plan aims to teach students about useful and harmful microbes in the farm environment.

Students will learn some of the simple steps they can take to reduce the risk of picking up an infection on a visit to a farm. They will also learn more about how microbes can spread in different environments.

Some of these simple steps include:

- Washing hands with soap and water after contact with animals and before eating and drinking (alcohol gel or hand wipes will not remove these microbes effectively).
- Avoid kissing or putting your face close to the animal’s face; and avoid putting your own hands near your face or in your mouth.
- Eating in the designated picnic areas/ cafe facilities.
- Not eating anything whilst walking around the farm or anything that has dropped on the floor.
- Washing soiled footwear thoroughly and then washing your hands thoroughly with soap and water.

### Key Words
- Farm
- Hygiene
- *E. coli*
- *Salmonella*
- *Campylobacter*
- *Rhizobia*
- Thermophiles
- *Lactobacilli*

### Materials Required
**Per student group**
- Copy of *SW 2 - SW 8*
- Farm Journey Game: board, counters, dice and cards

**Per Class**
- Copy of PowerPoint slides or *SW 1* for each student

### Available Web Resources
- A demonstration of this activity
- PowerPoint slides for main activity
- Interactive ‘Farm Fun’ game on Junior website to reinforce message of this lesson
- A film clip on Junior website showing the recommended method of hand washing with soap

### Alternative Suggestion
If PowerPoint is not suitable, PDFs of each slide can be downloaded and either copied on to acetates for an overhead or blown up for use as visual aids.

### Advance Preparation
Copy *SW 2 - SW 8* for each student group (4-5 students per group). Download PowerPoint slides or prepare *SW 1* for each student/group.

Prepare laminated board game for each group.
Introduction

1. Begin the lesson by asking students to identify some of the risks when visiting a farm e.g. tripping on uneven ground, working farm machinery, etc. Then ask if they think there is anything on the farm that could make them ill, e.g. eating the animal food! End the discussion by asking if there could be any harmful microbes on the farm that could make them ill.

2. Explain that some farm animals (that appear clean and healthy) may have microbes living on them that can't be seen, and don’t cause any harm to the animal, but that can make us ill if we pick them up.

3. Explain that these microbes normally live in animal droppings but that sometimes these droppings get on lots of different things. Ask students to imagine a cow scratching its bottom on a fence, and then scratching its face at the same place on the fence. Where are all the harmful microbes from the droppings now? On the cows bottom and face but also on the fence. Explain that when we touch these animals or places the animals have been we could pick up these harmful microbes on our hands, and if these microbes got inside our body, they could cause vomiting and diarrhoea.

4. Tell the students that they are going to learn about some of the harmful microbes at farms and how they can easily protect themselves when they visit a farm and touch the animals. Also tell them that they are going to learn about some useful microbes that can be found on the farm, and how these help in food production.

Main Activity

1. Present the students with each of the animal images (PowerPoint slides or PDFs can be downloaded from the website www.e-bug.eu).

2. For each animal, ask students to answer the question and discuss (teaching points are detailed in TS 4).

3. Then ask the students where on the farm they think there may be microbes that are useful to humans.

4. Ask the class if they have any ideas what these harmful and useful microbes on the farm might be called. Give students SW 1 – SW 6.

5. Ask the students to discuss what they can tell from the profiles about the risks and benefits of the different microbes, and whether they would want to make them their 'friends'. Discuss anything they noticed in the profiles that could help prevent the harmful microbes from spreading to people.

Secondary Activity

This ‘fun on the farm’ game will highlight precautions needed to prevent the spread of infection on a farm.

1. Group the students into teams of around 6 and give each group a board, counters, dice and pack of cards.

2. The students play the game by rolling the die and moving their counter along the board. If they land on a harmful microbe or useful microbe, the player to their left must pick up a card and ask the question on that card. The used card is then put to the bottom of the pack and the next player rolls. The winner is the player that gets to the end of the board first.

This game can also be played before a school trip to a farm. The scenarios can be linked to what the students will be doing, such as a tractor ride, or played as described above before the farm tour starts.
2.4 Spread of Infection
Farm Hygiene

Lesson Plan

Plenary (after classroom activity OR farm visit)
1. Discuss with students the importance of what they have learnt
   
   It is important to be aware of harmful microbes that animals may carry and maintain good hygiene in order to protect yourself from becoming ill.

   It is also important to remember that there are many more useful microbes on the farm that help farmers produce food for us every day.

2. Ask the class to pick out some things that they can do to protect themselves if they visit a farm. For example:
   a. Wash their hands with soap and water after touching the animals and before eating and drinking anything
   b. Eat in the designated picnic/ cafe area
   c. Do not eat anything that has fallen on the floor

3. Use this discussion to reinforce the main key health messages:
   - Farm animals can carry harmful microbes such as Salmonella, E. coli and Campylobacter that can make us unwell.
   - Washing hands with soap and water is very important, especially after touching animals and before eating and drinking.
   - Animals should not be kissed or touched near the mouth, rear end or feet; and children should avoid touching their faces or mouths whilst on the farm.
   - If children do get ill after visiting a farm, parents should contact their GP and they should remain off school for two days after the sickness and diarrhoea symptoms end, to reduce the spread of infection amongst their peers.

Extension Activity

Visit the Junior student section of the e-Bug website, www.e-bug.eu, to access the ‘Farm Fun’ interactive learning activity. This interactive animation allows students to spot things that the young visitors are doing wrong on the farm, and explains why each action may lead to harm.
Where on the cow might you find lots of harmful microbes?
Microbes tend to be concentrated in certain areas, such as the mouth, rear end, tail and feet, and students should avoid touching animals in these places, as they are more likely to become infected if they do. E. coli lives in the gut of the animal where it helps the animal digest food, and is therefore more likely to be concentrated in areas on the faecal-oral route and on the ground where droppings have been. Ask the students where they think the best place on the animal would be to stroke or pat (the answer should be the flank, neck or back).

Where on the farm might these goats spread any microbes they carry?
The goats can spread harmful microbes on any ground/areas on the farm that they walk on, any fences that they can touch, feeding equipment they eat from, or any humans or other animals that they have contact with. And remember that animals carry microbes that they need to keep them healthy, but if these microbes pass to humans they can make us unwell (for example E. coli in the animals gut helps the animal to digest food but if we ingest them they can give us diarrhoea). So we should wash our hands after contact with any animal on the farm, including farm pets like dogs and cats.

Why must you be careful to wash your hands after holding this chicken?
Chickens are fun to hold and make good pets, but chicken droppings can carry harmful microbes, so you should avoid stepping in the droppings if possible and make sure to wash your hands thoroughly with soap and running water after contact with the chickens.

Harry caught a tummy bug after visiting a farm – do you know why?
There are lots of useful and harmful microbes on animals and on surfaces around the farm, and a few of these microbes don’t harm the animals but can make us ill! It is important to wash your hands properly to remove any harmful microbes which may be present after contact with animals, and before you eat or drink anything. If you do become ill you should stay off school, drink lots of water and inform your GP that you have been on a farm visit.
Why should you be careful to wash your hands after holding this chicken?

Where on the cow might you find lots of harmful microbes?

Where on the farm might these goats spread any microbes that they carry?

Harry caught a tummy bug after visiting a farm – do you know why?
Profile

*Escherichia coli 0157 (Esk-Er-Ic-E-A)*

**Nicknames:** *E. coli*

**Address:** 1st Bend, Your Gut, The Human Body, N05E 2T0E

**Alternative Address:** 1 Goats Tongue, Cows Back Lane, Farm Hill, W00L 1EE

**Likes:** Making people sick (haha!), Animal droppings – Yum! I love to turn the human gut into a wild rapid ride that ends with a poo skydive down the loo... good times! Also, alcohol rub and hand wipes are my favourite, people think they are being so clever trying to wipe me away – little do they know that these things just won’t cut it. I’m stronger than that you know!

**Dislikes:** Antibiotics... Urgh! And drinking lots of water (it makes my life harder, sigh.) I also HATE soap and water, I have to cling on to the skin SO much harder than if people just used water to rinse their hands.

**The Wall**

*Steve the Sheep* *E. coli,* I’ve been missing you! Ever since you left me to go off on holiday to that human body! Hope you are having fun causing trouble in their tummy! Baa x

*Norovirus* Hey, just saw an advertisement for the *Convention of Vomiting and Diarrhoea* this year... we will be able to learn new ways of making people sick! Hooray! See you there, N.

*Doctor Alan* *E. coli,* you have been banished from my patients bodies, thanks to my clever suggestion that they should drink lots of $H_2O$ and stay away from other people until they get rid of you. Also the hand washing with soap worked a treat! Better luck next time!

**Add as Friend?**

Yes  No
My main aim in life is to settle down – but that never seems to happen! I can’t help it if I’m always causing food poisoning, can I?!

**Job:** I’m a proud member of the *Salmonella* Army – there are over 2500 different types of us!

**Address:** Stomach Hollow, The Human Body, V0M 1T5

**Alternative Address:** 2 Chicken Eggs, Nest Box, Field Green, 1CL UCK

**Likes:** Me and my *Salmonella* army pals like nothing more than to have a good old party down at the farm... they sure know how to make us welcome! But I also like to travel... I LOVE hot countries! So if you’re planning on going anywhere soon you could pick me up whilst you’re there!

**Dislikes:** Any people who wash their hands with soap... spoil my holidays won’t you!

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**The Wall**

**Travel Operator Bob** This is a quick message to say thank you for travelling overseas with us! With your help, together we are really reaching every corner of the globe! Next time I hope you bring your friends!

**Daisy Duck** *Salmonella*, will you just leave my eggs alone!! Everyone’s stopped buying them since you came along and I really need the money – I’ve got my eye on a new pond... and you’re ruining my plans!!!

**Doctor Alan** Oh I see – animals’ guts aren’t enough for you, you even want to conquer beansprouts to satisfy your infectious cravings! Don’t worry, I’m preparing to ensure all my patients wash and cook all of their raw food carefully to spite you!

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**Add as Friend?**

Yes  No
Profile

Campylobacter  (Cam-pie-low-back-ter)

Address: Round Stomach Lane, The Human Body, PA1N FUL

Alternative Address: 1 Under Cooked, Poultry Lane, Market Farm,  M3AT RAW

Likes: Playing gut twister! Although, even if I do say so myself, I’m pretty good at cramping up your insides! I also like chicken and unpasteurised milk... they are pretty cool places to hang. Got any raw meat in your fridge? I’m not fussy, if it is sitting around, I’ll make it my home.

Dislikes: Well cooked meat and high oven temperatures... they are the enemy!

The Wall

Patient Amy You are horrible Campylobacter, you’ve made me SO ill! I wish I had never made friends with you!

Kevin the Chicken Hi mate, just you go careful and wear sun screen when you visit that kitchen this week – you might die if the temperature in that oven is too high!

Doctor Alan Campylobacter... I’m on to you! I know you hide around and can spread to other people even after my patients start feeling better. But you better watch out... I’ve been warning them about the benefits of washing hands with soap and water!

Add as Friend?
Yes  No
**Group**

**Rhizobia** *(Rye-zo-bee-a)*

**Nicknames:** Nitrogen fixing bacteria

**Address:** Roots Range, Legume Lane, Under Earth Village, N1TR OG3N

**Likes:** We are ‘stay at home’ kind of microbes, once we find a nice spot on a root, we hang out there all day and night! Not that we are lazy though – we pay our way by filling the soil with loads of ammonia that plants need to grow, using natural gas that is in the air!! Sounds like magic, but it’s all about the tricks of the trade… and it keeps us with a roof over our heads!

**Dislikes:** Too much oxygen – I know it sounds silly to you humans but we just don’t like it, it messes up our important work.

**The Wall**

**Clive the Clover** Hey, how you doing down there? There’s a load of seeds on their way that are being really fussy, so we need to work extra hard to make the soil just right for them! We can’t do this alone, you and me need to work together to get this right!

**Farmer David** Hi guys, thought you might like to know – I just won an award for my fantastic cereal crop at the town hall. I just wanted to say, I couldn’t have done it without you – thanks very much!
**Farm Hygiene**  
*e-Bug Social Networking*

**Group**

**Thermophiles** *(Therm-oh-fi-alls)*

**Nicknames:** a big group of heat lovers!

**Address:** Peat Bog, Compost Bin, Round Barn Yard, TOAS T1E

**Alternative Address:** Cereal Lane, Over Soil Spread, Field Green, 1MEA DOW

**Likes:** We LOVE a good old pile of plant clippings – mix in some cut grass and soil and that makes a fabulous meal! To be a member of the thermophile gang, you can be a bacterium or a fungus – it’s all about working in high temperatures! Decaying plants are our specialty – we break them down and recycle them right back into yummy yummy nutrients, all in the comfort of tropical heat!

**Dislikes:** You know we like heat – but we hate the cold! And when we say cold we mean 20ºC - at those temperatures the bacteria among us won’t even get out of their nice protective endospores! Brrrr!

**The Wall**

**Sally Strawberry** Hi thermophiles, thanks for my tasty dinner that you created in the compost kitchen, it was fantastic! I’ll be asking Farmer David for some more next week, so keep going! X

**Lactobacilli** Dear all, I hope you will be coming to my party next week – it’s a field party to celebrate another year of great food production on the farm. I just hope it doesn’t get gate crashed – I don’t want any nasty bacteria to come!

**Eco Eddie** Congratulations thermophiles, you have been nominated for an eco-award for all your recycling efforts. By turning all that plant waste into nutrients for the farm, you really help the ecosystem. Well done!

**Subscribe to group?**  
Yes  
No
**Nicknames:** Probiotic bacteria

**Address:** Swimming Inn, Cow’s Milk Pond, Dairyfresh Farm, F3R M3NT

**Alternative Address:** 1. Useful Microbe, Small Intestine Corner, Tummy Place, PPL5 GUT

**Likes:** Our favourite food is lactose – man that milk sugar is hard to beat!! It gives us bags of energy, and we know it makes everyone happy when the result of our fermentation is a lovely smooth yogurt fit for a king! Also, some of us are great at making silage – fermented grass that cows and sheep can eat all year round... they love it!

**Dislikes:** Nasty microbes that are horrible to humans – what’s up with that? Humans and Lactobacilli have always been bessie mates – we help each other out, right?!

**The Wall**

**Society for Dairy Products** Dear Lactobacilli members, we are holding a lesson on the importance of bacterial cultures to the food supply, and were hoping you could do a presentation? You really are some of the best at this sort of thing! Please get back to us soon.

**Patient Amy** Thanks so much all you friendly Lactobacilli, after Campylobacter came to stay, you really helped me get back on my feet and feel healthy again. Love Amy x

**Dorothy the Cow** Keep it up Lactobacilli! Because of all your help, my milk is really popular and is selling out fast! Soon I’ll be able to afford that holiday to the beach I’ve always wanted... I can’t wait to feel the sand beneath my hooves!

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**Subscribe to group?**

Yes  No
Fun on the Farm!

The Rules

1. Roll the die to see which player goes first – highest roll gets it!
2. Take turns in a clockwise order to roll the die and move along the board.
3. If you land on a microbe, the person to your left must pick up a card from the pack and ask you the question.
4. Whoever gets to the end of the board first wins!

Select your counter
Move back 3 spaces
But stay where you are if you can answer the question

Why should you not eat sweets in the animal pen?
Harmful microbes can be passed to your mouth when you eat, which can make you unwell.

Move back 5 spaces
But stay where you are if you can answer the question

Why might there be harmful microbes on fences?
Animals carry harmful microbes on their body and can pass these microbes on to the fence when they walk past the fence, scratch their behind on it or lick or slobber on it.

Move back 4 spaces
But stay where you are if you can answer the question

There are only harmful microbes on the farm.
Is this true or false?
False – there are lots of useful microbes on the farm that help the farmer produce food for us to eat.

Move back 2 spaces
But stay where you are if you can answer the question

The teacher caught you sucking your thumb when you were playing with a pet calf. Why is this a bad thing to do?
Harmful microbes can be passed to your mouth when you suck your thumb, which can make you unwell.

Move back 1 space
But stay where you are if you can answer the question

Using soap and water to wash your hands is better than using hand gel.
Is this true or false?
True, because it removes more harmful microbes.

Swap places with the person in last place
But stay where you are if you can answer the question

Why should we wash our hands after playing with animals?
Animals carry harmful microbes that can make you unwell. You can pick these microbes up when you touch them.

Swap places with the person behind you
But stay where you are if you can answer the question

Why should we only eat food where the farmer tells us?
The farmer will tell you to eat in an area where you can wash your hands and where animals aren’t allowed, so there will be less chance of picking up harmful microbes.

Swap places with the person in last place
But stay where you are if you can answer the question

Why should you not eat sweets in the animal pen?
Harmful microbes can be passed to your mouth when you eat, which can make you unwell.

Swap places with the person behind you
But stay where you are if you can answer the question

Why should we wash our hands after playing with animals?
Animals carry harmful microbes that can make you unwell. You can pick these microbes up when you touch them.

Swap places with the person in last place
But stay where you are if you can answer the question

Why should we only eat food where the farmer tells us?
The farmer will tell you to eat in an area where you can wash your hands and where animals aren’t allowed, so there will be less chance of picking up harmful microbes.

Move back to space number 2
But stay where you are if you can answer the question

Can you name 1 harmful microbe that you might find on the farm?
Either: E. Coli, Salmonella, Campylobacter

Move back 1 space
But stay where you are if you can answer the question

Using soap and water to wash your hands is better than using hand gel.
Is this true or false?
True, because it removes more harmful microbes.
You washed away some harmful microbes when you washed your hands after playing with the animals.

Move on 3 spaces

You saw an animal scratching its backside on a fence and stayed away from it because it might be covered in harmful microbes.

Move on 5 spaces

You helped that farmer show that he uses useful microbes to make silage.

Swap places with the person in the lead

The farmer thought that you were very clever because you knew that there were some useful microbes on the farm that help make crops grow.

Move to on 4 spaces

You helped some smaller children wash their hands before they had their lunch.

Move on 4 spaces

If you can name 1 place on the farm where there are useful microbes.

Swap places with the person in front of you

One from: Compost bin, in the soil, in the dairy shed, in the silage tank, in the farm kitchen, root nodules

You rinsed off your wellie boots before you left the farm washing away any microbes that might be on them.

Move on 1 space

If you can tell why we should wash our hands with soap and water and not just hand gel or wet wipes.

Move on 8 spaces

Soap breaks up the oils on our hands that microbes stick to, and water rinses them away. Hand gel does not remove microbes from the hands, so soap and water is better.

If you can name 3 places on the farm where there might be harmful microbes.

Swap places with the person in the lead

Three from: On an animal’s body, in the animal’s pen, in animal’s poo, on a fence, on the ground where animals walk
What should you do if you have tummy ache a couple of days after visiting the farm?

Stay off school and drink lots of fluids, and ask your parent to let your GP know that you were on a farm visit.

Can harmful microbes be found on pets that live at home?

Yes, pets can carry harmful microbes that can make you unwell, so wash your hands after playing with them.

Can you still eat your sandwich if you drop it on the ground whilst on the farm?

No, harmful microbes could have transferred to the sandwich from the ground. If you eat it, it may make you unwell.

Why is it better to wear wellies rather than trainers whilst visiting the farm?

Wellies are easier to rinse off at the end of the visit, and have less crevices where microbes can stick and hide.

You see an apple that has fallen from the apple tree into the cow field, and you feel hungry. Why should you not eat it?

No, harmful microbes could have transferred to the apple from the ground. If you eat it, it may make you unwell.

Which is better – washing hands under running water from an outside tap, or in a bowl of water?

Running water – because it removes more harmful microbes and the water is cleaner.
You remembered to give your parents the information sheet from the farmer about what to do after the farm visit

Move on 3 spaces

You dropped a sweet on the ground and put it straight into the bin

Move on 5 spaces

You fell over and got muddy hands, so you washed them with soap and water before touching other people

Swap places with the person in the lead

You remembered to eat your lunch in the picnic area, and you washed your hands on the way

Move to the next even square

You remembered that animal poo can contain harmful microbes, so you avoided stepping in the cow pat!

Move on 4 spaces

There are more useful microbes than harmful microbes on the farm – true or false?

Swap places with the person in front of you

True – many of these microbes help the farmer to produce food for us.

You took off your shoes when you got home from the farm and left them in the porch so that an adult could clean them

Move on 1 space

If you can name a useful microbe that can be found on a farm

Move on 8 spaces

Either: Lactobacilli, Thermophiles, Rhizobia

If you can name a type of food or drink that is made with the help of a useful microbe on the farm

Swap places with the person in the lead

Either: yogurt, milk, bread, cereal or any other crop or vegetable, fruit cider, beer
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This is a fun and educational game designed for children to learn counting and basic arithmetic. The game involves moving from one number to another, following the path marked with the numbers. Each number represents a step in the sequence. The goal is to reach the end of the path, which is usually marked by a specific number or a target location. This game helps in developing number sense, sequential thinking, and problem-solving skills.
Section 3.1 covers the topic of disease prevention through the body’s own natural defenses.

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 2 sections of this resource.

**Learning Outcomes**

All students will learn that:
- The human body has many natural defenses to fight infection
- Our bodies have 3 main lines of natural defenses
- Sometimes the body needs help to fight infection

**National Curriculum Links**

P2 - P7
- SCN 1-20a
- SCN 2-20a
- HWB 1-15a, 2-15a
- HWB 1-16a, 2-16a
- HWB 1-17a, 2-17a

**Unit of Study**
Unit 6 – Micro-organisms

**Estimated Teaching Time**
50 minutes
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.eu
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.
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 Eyes
   Tears produce chemicals called enzymes which kill bacteria on the surface of the eye.

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
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
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.

**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

**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.
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) 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.
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.
**Scene 1 - by a river**

<table>
<thead>
<tr>
<th>Narrator</th>
<th>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.</th>
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</thead>
<tbody>
<tr>
<td>Jenner</td>
<td>What a lovely day to go looking for fossils on the bank of the river Severn. What could be more perfect!</td>
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<tr>
<td>Narrator</td>
<td>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!</td>
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</tbody>
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**Scene 2 - Dr Jenner's office**

| Jenner | Oh come in come in, what seems to be the problem Mr and Mrs Smith? |
| Mrs Smith | Well Dr Jenner, my husband has got himself a cowpox rash. What can be done for him? |
| Mr Smith | Also doctor, a friend of mine died last year from smallpox. But he never had cowpox. |
| Jenner | Yes, do go on Mr Smith. |
| Mr Smith | 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? |
| Jenner | 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. |
| Narrator | 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**

| Sarah | Doctor, I’ve got a cowpox rash on my hand. |
| Jenner | OK Miss Nelmes, let me take a look at that. Right young James, come here please and hold out your hand. |
| Sarah | What are you doing doctor? |
| Jenner | An experiment Miss Nelmes. I shall take some of the pus from your rash and scratch it into James’ hand. |
| Narrator | 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. |
| Jenner | James my boy, if all goes to plan your name will go down in medical history! |
| James | But what if it doesn’t go to plan Dr Jenner? |
| Jenner | I won’t lie to you James, you might well die! |
| James | (Gulps) Oh! |
| Narrator | 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. |
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!

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.

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.
Section 4, Treatment of Infection, explores the use of antibiotics and medicine in treating various illnesses and disease.

This is a student discussion activity. Students are exposed to a range of scenarios in Amy and Harry’s school day. Students discuss the various comments made throughout the cartoon and decide whether or not they agree.

**Learning Outcomes**

**All students**
- Will understand that most common infections get better on their own through time, bed rest, liquid intake and healthy living
- Will understand that if antibiotics are taken, it is important to finish the course
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.
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.

Introduction

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) and discuss whether the decision maker has made the right or wrong choice.

4. Discussion points can be found in TS 3.
Check for understanding by asking the children the following questions

1. What is the cause of infections?
   The cause of the infection is Harmful Microbes.

2. What are medicines?
   Medicines are any substance used in the treatment of disease or the symptoms of a disease.

3. What are antibiotics?
   Antibiotics are special medicines used to treat bacterial infections.

4. Why should we not use other people’s antibiotics?
   Different antibiotics kill different bacterial infections so antibiotics prescribed for an ear infection might not work on an infected wound.

5. What might happen if we don’t finish our antibiotics?
   Not finishing a course of antibiotics may result in the bacteria causing the infection surviving. These bacteria will have been exposed to the antibiotic treatment and learned how to fight the antibiotics the next time they are used i.e. they will become resistant to the antibiotic therapy.

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1. This activity can be carried out either individually or in groups of 2 – 4 students.

2. Provide students with SW 1.

3. Students should match the word on the left hand column with the definition on the right hand column.
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 is 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.
4. After they had eaten, the children went out to play. Harry fell over and cut his knee very deeply.

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

Owww my knee is bleeding.

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.

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

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

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?

Oh no, he gave me antibiotics to help fight the infection but told me to take them until they were all finished.
**Antibiotic**: The smallest of the microbes - usually harmful

**Bacteria**: A drug used to treat a disease or injury

**Infection**: A sign of illness e.g. headache, diarrhoea and fever

**Medicine**: Special medicine used to treat bacterial infections

**Painkiller**: A disease caused by a microbe

**Virus**: Very small microbe that can be helpful or harmful

**Symptom**: A drug used to take away pain
<table>
<thead>
<tr>
<th><strong>Antibacterial soap</strong></th>
<th>A soap that kills some bacteria. Antibacterial soaps are being increasingly marketed but they have no added value over soap in the school setting.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antibiotic</strong></td>
<td>A type of medicine which is used to destroy or prevent the growth of bacteria.</td>
</tr>
<tr>
<td><strong>Antibody</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Antigen</strong></td>
<td>A special marker or part of a microbe that when introduced into the body stimulates the production of an antibody by white blood cells.</td>
</tr>
<tr>
<td><strong>Bacteria</strong></td>
<td>Microscopic single celled microbe that can be beneficial or harmful to humans.</td>
</tr>
<tr>
<td><strong>Bug</strong></td>
<td>Another word for a microbe.</td>
</tr>
<tr>
<td><strong>Cell</strong></td>
<td>The smallest structural unit of an organism that is capable of working independently.</td>
</tr>
<tr>
<td><strong>Colony</strong></td>
<td>A group of microbes grown from a single parent cell.</td>
</tr>
<tr>
<td><strong>Colonise</strong></td>
<td>Ability to survive and grow on humans without necessarily causing harm.</td>
</tr>
<tr>
<td><strong>Contagious</strong></td>
<td>Able to be spread to others through direct or indirect contact.</td>
</tr>
<tr>
<td><strong>Contamination</strong></td>
<td>Impurity or uncleanness when an area or thing is covered with microbes.</td>
</tr>
<tr>
<td><strong>Cross-contamination</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Culture</strong></td>
<td>The growth of microbes in a specially prepared growth medium.</td>
</tr>
<tr>
<td><strong>Dermatophytes</strong></td>
<td>A group of fungi that like to grow in or on the skin and scalp.</td>
</tr>
<tr>
<td><strong>Disease</strong></td>
<td>An illness that has a group of signs or symptoms.</td>
</tr>
<tr>
<td><strong>Experiment</strong></td>
<td>A test carried out to observe whether or not an idea or theory is true.</td>
</tr>
<tr>
<td><strong>Fermentation</strong></td>
<td>A process by which microbes break down complex sugars into simple compounds such as carbon dioxide and alcohol.</td>
</tr>
<tr>
<td><strong>Fungi</strong></td>
<td>The largest of the microbes. Unlike bacteria or viruses, fungi are multi cellular.</td>
</tr>
<tr>
<td><strong>Germs</strong></td>
<td>Another word for harmful or pathogenic microbes.</td>
</tr>
<tr>
<td><strong>Hygiene</strong></td>
<td>Conditions and practices that serve to promote and preserve health and reduce spread of infection.</td>
</tr>
<tr>
<td><strong>Illness</strong></td>
<td>Poor health resulting from disease.</td>
</tr>
<tr>
<td><strong>Word Glossary</strong></td>
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<td>-------------------</td>
<td></td>
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<tr>
<td><strong>Immune system</strong></td>
<td>The collection of organs, tissues, cells, and cell products such as antibodies that helps to remove microbes or substances from the body.</td>
</tr>
<tr>
<td><strong>Immunise</strong></td>
<td>Perform vaccinations or produce immunity by inoculation of a substance that is similar to part of the microbe you want to protect against.</td>
</tr>
<tr>
<td><strong>Incubate</strong></td>
<td>To maintain at the best temperature and conditions for growth and development.</td>
</tr>
<tr>
<td><strong>Infection</strong></td>
<td>A disease caused by a microbe.</td>
</tr>
<tr>
<td><strong>Infectious</strong></td>
<td>Capable of causing an infection. A person, animal or thing that can pass microbes on.</td>
</tr>
<tr>
<td><strong>Inflammation</strong></td>
<td>A protective attempt by the body to remove the microbe or unknown substance as well as initiate the healing process for the tissue.</td>
</tr>
<tr>
<td><strong>Medicine</strong></td>
<td>A substance, used to treat disease or injury.</td>
</tr>
<tr>
<td><strong>Microbe</strong></td>
<td>A shortened form of ‘micro-organism’.</td>
</tr>
<tr>
<td><strong>Micro-organism</strong></td>
<td>Living organisms that are too small to be seen with the naked eye.</td>
</tr>
<tr>
<td><strong>Microscope</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Natural Barrier</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Natural Defence</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Pathogen</strong></td>
<td>A microbe that can cause an illness.</td>
</tr>
<tr>
<td><strong>Phagocytes</strong></td>
<td>White blood cells which attack any foreign objects which enter the blood stream.</td>
</tr>
<tr>
<td><strong>Phagocytosis</strong></td>
<td>The method by which phagocytes engulf and digest unwanted microbes.</td>
</tr>
<tr>
<td><strong>Plasma</strong></td>
<td>The yellow coloured liquid of the blood in which the blood cells are suspended.</td>
</tr>
<tr>
<td><strong>Prediction</strong></td>
<td>An educated guess about future events.</td>
</tr>
<tr>
<td><strong>Probiotic</strong></td>
<td>Literally means ‘for life’. Probiotics are bacteria that aid human digestion.</td>
</tr>
<tr>
<td><strong>Results</strong></td>
<td>The outcome or effect of an experiment.</td>
</tr>
<tr>
<td><strong>Symptom</strong></td>
<td>A sign of illness, e.g. headaches, fever and diarrhoea.</td>
</tr>
<tr>
<td><strong>Toxin</strong></td>
<td>A harmful substance produced by some harmful microbes.</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Transfer</strong></td>
<td>To move from one place to another. Spread of a microbe.</td>
</tr>
<tr>
<td><strong>Transmission</strong></td>
<td>Movement from one place to another.</td>
</tr>
<tr>
<td><strong>Virus</strong></td>
<td>The smallest of the microbes, viruses cannot survive on their own and need to live in the nucleus of other living organisms.</td>
</tr>
<tr>
<td><strong>Vaccination</strong></td>
<td>Inoculation with a vaccine in order to protect against a particular infection.</td>
</tr>
<tr>
<td><strong>Vaccine</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>White blood cell (WBC)</strong></td>
<td>Cells found in the blood which help protect the body against infection and disease.</td>
</tr>
</tbody>
</table>
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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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.


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.'