

e-Bug: An international educational resource covering the world of microbes and disease.



e-Bug

operated by UK Health
Security Agency

Lesson plans, worksheets and activities



**Key Stage 2
(7-11yrs)**

www.e-bug.eu

Welcome to e-Bug

e-Bug has been designed to bring the world of microbes and antibiotics to life for children in the school environment. It is a curriculum supplement series (Early Years, Key Stage 1, 2, 3 and 4) that complies with the Department for Education educational standards for junior and senior schools.

This resource has been created by the UK Health Security Agency (formerly Public Health England) in collaboration with 17 EU partner countries to foster an interest in science and to improve young people's knowledge and understanding about microbes, infection prevention and control, and prudent antibiotic use, thereby

empowering them to be proactive in looking after their own health. Lesson plans can be used in sequence or as individual activities designed to fit into 50-minute classroom slots. These tools can be used freely by educators and may be copied for classroom use but may not be sold.

Over 27 international countries are involved in the e-Bug project, and the resources have been evaluated with more than 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, images and additional activities can be downloaded (www.e-bug.eu).

Each section of the pack contains detailed lesson plans, student worksheets and handouts; some of which are available in MS PowerPoint format for whiteboard use:

- **Creative inquiry based activities to promote active learning**
- **Highlighted learning outcomes which**

deepen students' understanding of the importance of microbes, their spread, treatment and prevention

- **Activities that encourage students to take more responsibility for their own health**
- **Activities that highlight the importance of responsible antibiotic use**

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.

We would especially like to thank the teachers and students across the UK, and Europe who participated in focus groups and the evaluation process and helped ensure that these materials are not only fun and exciting but also effective.

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

If you would like to keep up to date with our latest resources, or the research and development that we undertake please register for our quarterly newsletter at: www.e-bug.eu/uk-newsletter

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:

Primary Care and Interventions Unit
UK Health Security Agency
Twyver House, Bruton Way
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Or alternatively visit the e-Bug website and contact us at www.e-bug.eu/uk-contact-us

The e-Bug Team

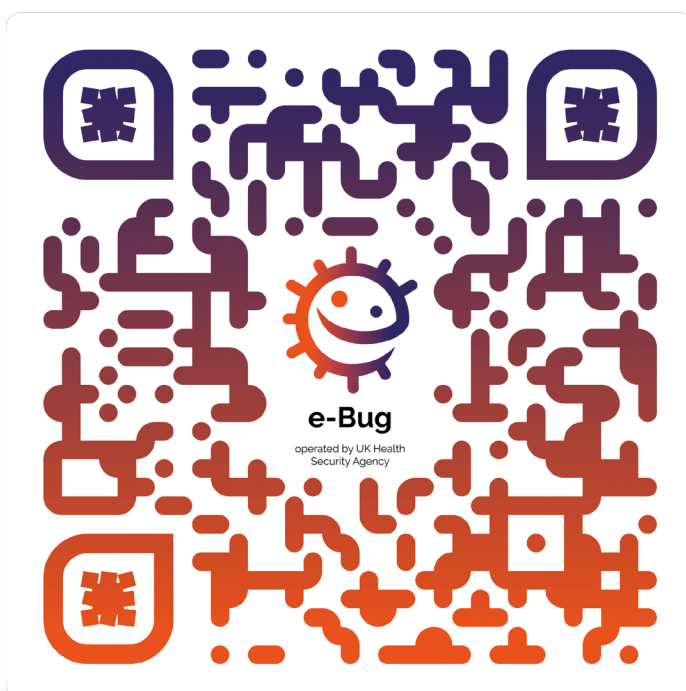
Take our teacher survey!

To celebrate the launch of the new e-Bug packs in England, every teacher that completes our new survey will be entered into a prize draw to win a set of giant microbes (www.giantmicrobes.com) for your school.* Your feedback will help us improve e-Bug.

Winners will be announced at the end of January 2022

To enter please scan the QR code below:

**One entry per person*



www.e-bug.eu/ukpacksurvey

An international educational resource covering the world of microbes and disease

e-Bug resources are available in the following languages

Basque Country - Basque, Spanish

Belgium - French

Bulgaria - Bulgarian

Cyprus - Cypriot

Czech Republic* - Czech

Denmark* - Danish

England* - English

France* - French

Germany* - German

Greece* - Greek

Hungary - Hungarian

Ireland - English, Gaelic

Italy* - Italian

Kosovo - Albanian

Latvia - Latvian

Lithuania - Lithuanian

Norway - Norwegian

Poland* - Polish

Portugal* - Portuguese

Romania - Romanian

Saudi Arabia - Arabic

Scotland - English, Gaelic

Spain* - Spanish

The Netherlands - Dutch

Turkey - Turkish

Ukraine - Ukrainian

Wales* - English, Welsh

**Original partner countries*

Visit www.e-bug.eu to view our partner profiles and translated versions of the resources.

e-Bug is operated by UK Health Security Agency



The e-Bug Learning Journey

**Key
Stage 2**

**Ages: 7 to 11
years**

**Early
Years**

**Ages: 3 to 5
years**

The e-Bug learning journey begins..

Children are introduced to microbes and positive behaviours for hand washing, respiratory and oral hygiene.

Oral health

Students learn about dental plaque and the impact of sugar on their teeth.

Marvellous Microbes

Students develop their hand and respiratory knowledge and explore different types of harmful and useful microbes.

**Key
Stage 1**

**Ages: 5 to 7
years**

Spread of infection

Micro-organisms



e-Bug

Discovery

Students are introduced to vaccines, antibiotics and the transmission of microbes from and to food and animals.

Empowered

Students increase their knowledge of antimicrobial resistance, understand how to communicate important scientific messages within the community and strengthen their self-care techniques.

Infection control

Students apply their problem-solving skills to outbreaks and are introduced to herd immunity and infectious diseases.

Sexual Health

Students learn how easily infection can spread through sexual contact and how to protect themselves.

Prevention of infection

**Key
Stage 3**

**Ages: 11 to 14
years**

**Key
Stage 4**

**Ages: 14 to 16
years**

Treatment of infection

Contents

Key Stage 2

Micro-organisms

Lesson 1 – Introduction to Microbes

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.

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Micro-organisms

Lesson 2 – Useful Microbes

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

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Micro-organisms

Lesson 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 wordsearch.

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Spread of Infection

Lesson 4 – Hand Hygiene

By taking part in 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.

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Spread of Infection

Lesson 5 – Respiratory Hygiene

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

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Spread of Infection

Lesson 6 – Food Hygiene

Students will go through an interactive quiz which follows the preparation of a meal. Along the way, students will have to make decisions about what to do next and answer questions.

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Spread of Infection

Lesson 7 – Animal and Farm Hygiene

Students play an interactive memory card game to highlight the similarities between human and animal health.

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Prevention of Infection

Lesson 8 – Oral Hygiene

Students learn how they can prevent tooth decay. The activities demonstrate the importance of brushing teeth twice a day and how much sugar many common drinks contain.

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Prevention of Infection

Lesson 9 – Vaccinations

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

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Treatment of Infection

Lesson 10 – Antibiotics

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

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All lesson plans and supporting materials contained in this pack are available to download as modifiable templates from the e-Bug website.



Key Stage 2 National Curriculum Links

Micro-organisms

Lesson 1 – Introduction to Microbes

Science:

Working scientifically,
Living things and their habitats

PHSE/ RSHE:

Health and prevention

English:

Reading and comprehension

Art & Design:

Painting, Recording observations

Micro-organisms

Lesson 2 – Useful Microbes

Science:

Working scientifically

PHSE/ RSHE:

Health and prevention

English:

Reading and comprehension

Micro-organisms

Lesson 3 – Harmful Microbes

Science:

Working scientifically

PHSE/ RSHE:

Health and prevention

English:

Reading and comprehension

Spread of Infection

Lesson 4 – Hand Hygiene

Science:

Working scientifically,
Living things and their habitats, Animals, including humans

PHSE/ RSHE:

Health and prevention

English:

Reading and comprehension

Design & Technology:

Cooking and nutrition

Art & Design:

Painting, Recording observations

Spread of Infection

Lesson 5 – Respiratory Hygiene

Science:

Working scientifically,
Living things and their
habitats, Animals,
including humans

PHSE/ RSHE:

Health and prevention

English:

Reading and
comprehension,
Spoken language

Spread of Infection

Lesson 6 – Food Hygiene

Science:

Working scientifically,
Living things and their
habitats, Animals,
including humans

PHSE/ RSHE:

Health and prevention

English:

Reading and
comprehension,
Spoken language

Design & Technology:

Cooking and nutrition

Spread of Infection

Lesson 7 – Animal and Farm Hygiene

Science:

Working scientifically,
Living things and their
habitats, Animals,
including humans

PHSE/ RSHE:

Health and prevention

English:

Reading and
comprehension

Prevention of Infection

Lesson 8 – Oral Hygiene

Science:

Working scientifically,
Animals, including
humans

PHSE/ RSHE:

Health and prevention

English:

Reading and
comprehension

Prevention of Infection

Lesson 9 – Vaccinations

Science:

Working scientifically

PHSE/ RSHE:

Health and prevention

English:

Reading and
comprehension

Treatment of Infection

Lesson 10 – Antibiotics

Science:

Working scientifically,
Animals, including
humans (Upper KS2
only)

PHSE/ RSHE:

Health and prevention

English:

Reading and
comprehension



Teacher Refresher Information

Optional background information for each of the topics has been included to help you plan your lessons and introduce the topic to students.

There are several ways our bodies can be exposed to infection and many things that we can do to help prevent the spread of infection. This teacher refresher section only provides supporting information for each of the activities contained in this pack.

Micro-organisms:

Introduction to Microbes

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

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

Bacteria are single-celled organisms that are smaller than fungi but larger than viruses. They can be divided into three main groups by their shapes – cocci (balls), bacilli

(rods) and spirals. Cocci can also be broken down into three shapes – clusters, chains or groups of two. These shapes can be used to help identify the type of infection a patient has. If a single bacterial cell was scaled up 5,000 times it would be the size of a garden pea.

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

Most microbes are not harmful, and it is important to remind students of this. Some microbes are only harmful to humans when taken out of their normal environment.

Escherichia coli (*E. coli*) is commonly found in our gut and is harmless, but if it is transmitted to the urinary tract it can cause bladder and kidney infections.

Useful microbes

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

Fermentation changes the product from one food to another.

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

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

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

Harmful microbes

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

When harmful bacteria reproduce in our bodies, they can produce harmful substances called toxins which can make us very unwell, fortunately this is rare. Once inside a cell, they multiply until fully grown and leave the host cell.

Dermatophytes generally prefer to grow or colonise under the skin and the products they produce while feeding cause swelling and itching. Someone who is ill because of a harmful disease-causing microbe is said

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

Hand Hygiene

Why is hand hygiene so important?

Our hands are naturally covered by useful bacteria – *Staphylococcus* is a common example (ball shaped bacteria arranged in clusters) however, we can pick up harmful microbes from the things we touch. Hand hygiene is possibly the single most effective way of reducing and preventing the spread of these microbes and any associated infection. Schools and community groups are a relatively crowded and closed environment where microbes can spread easily and rapidly from child to child via direct contact or via surfaces. Some of these microbes can be harmful and cause illnesses. Washing our hands with soap and water at key moments removes any harmful microbes we pick up on our hands from our surroundings e.g. home, school, garden, animals, pets, food. Effective hand washing has been shown to reduce absenteeism rates in schools. Washing our hands also helps prevent the spread of antibiotic resistance which can make infections more difficult to treat. Where possible, liquid soap should be used instead of bars of soap, especially if used by multiple people.

Why is soap needed for effective hand washing?

Our skin naturally secretes oil (called 'sebum') which helps to keep our skin moist, stops it getting too dry and keeps our skin microbiome (micro-organisms that live on our skin) healthy. This oil, however, is a perfect place for microbes to grow and multiply, and the oil helps microbes "stick" to our skin. Washing hands in water alone will only remove visible dirt and grime invisible microbes may remain. Soap is required to break up the oils on the surface of the hands and should be applied well to all surfaces of the hand, producing a lather which helps to lift the dirt and microbes. It is important to rinse our hands to help remove the dirt and microbes.

If soap is unavailable, hand sanitisers, with at least 60% alcohol can also be effective as long as there is no visible dirt/other substance on hands (these need washing with soap and water). They should be applied to all parts of the hands and rubbed until dry (about 20 seconds - the length of the happy birthday song twice). Hand sanitisers with ingredients like alcohol work by destroying microbes as they dry, but don't kill all types of harmful microbes and don't remove visible dirt or other substances from our skin. Therefore, hand sanitisers should not be generally used after using the toilet.

When are the key moments for hand washing?

- Before, during and after preparing food
- Before eating or handling ready to eat food
- After using the toilet or changing a soiled nappy/underwear
- After exposure to animals or animal waste
- After coughing, sneezing or blowing your nose
- If you are ill or have been around ill people

- When you get home or go into another place like work, school, or another household (especially in an outbreak situation)

Respiratory Hygiene

Respiratory tract infections (RTI) are infections that happen in the lungs, chest, sinuses, nose and throat, for example, coughs and colds, the flu and pneumonia. RTIs can spread easily from person-to-person through the air, through person-to-person contact (touching hands, hugging, kissing) or by touching contaminated surfaces. COVID-19 is the name of the disease caused by the virus SARS-CoV-2. The virus can be spread by getting into the non-infected person's nose or eyes because they touch their face with contaminated hands. Coughing and sneezing is a way in which our body tries to get rid of any harmful microbes and particles we might inhale from getting deeper into our respiratory tract. These get caught on the nose hair or might irritate the back of our throat or our lungs. This sends a message to the brain which then sends a message back to our nose, mouth, lungs and chest telling them to blow the irritation away. In the case of the cold millions of virus particles rush out, spread through the air and contaminate the surface they land on; this could be our food, surfaces or hands.

It is important that good respiratory hygiene is taught from a young age, and that key messages are built on over time. This is especially important in the approach to the winter cold/flu season each year, or when there is an outbreak of an infectious disease. Common symptoms of a respiratory infection can include headache, sore throat, fever, and sometimes a runny or blocked nose. These infections can also cause sneezing and/or coughing, loss of taste or smell, and rarely nausea/vomiting or diarrhoea. To prevent the spread of harmful microbes from coughs or sneezes: dispose of tissues and regularly wash your hands.

- **Catch it:** cover your mouth and nose with a tissue. If you don't have a tissue, cover with your upper sleeve or elbow (not your hands).
- **Bin it:** throw away the used tissue at once to avoid spreading infection to surfaces, or other people.
- **Kill it:** wash your hands well with soap and water, or hand sanitiser if soap and water are not available, immediately after having binned the tissue.

We can help prevent the spread of these infections (like the flu) by getting vaccinations. Another way of preventing the spread of cold and flu is learning how to successfully practice good respiratory hygiene when we cough or sneeze. It is a natural reflex to put our hands towards our faces when we sneeze, but it is important to replace this action with new habits of respiratory hygiene to reduce the spread of infection.

Food Hygiene

Harmful microbes found in food can lead to food poisoning e.g. bacterial species such as *Salmonella*, *E. coli* and *Campylobacter* are commonly found on raw meats and can cause diarrhoea and vomiting in humans and sometimes even death – though this is rare. The symptoms of foodborne illness usually start within a few days of eating the food that caused the infection. They are usually better within a week and can include stomach pains, diarrhoea, vomiting, nausea, general fatigue/ache/chills and fever. Not everyone will experience these symptoms, but they can usually be treated at home.

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 yoghurt and cheese making.

Food spoilage is the deterioration of the colour, texture and flavour of food. It can be caused by many things, including microbes. For example, the fungus *Rhizopus stolonifer*

causes bread mould. Microbes that cause **foodborne illness** may or may not cause food spoilage.

There are four key ways you can prevent food poisoning and food spoilage:

1. Cleaning 'as you go' during food preparation to avoid the build-up of mess and prevent bacteria from spreading.
2. Cooking food until it has reached 70°C and stayed at that temperature for 2 minutes. General advice is that white meat/mince should be steaming hot and cooked all the way through (juices run clear).
3. Chilling, including cooling it down quickly to stop microbes from multiplying and storing food correctly. Refrigerators should be kept ≤4°C.
4. Preventing cross-contamination of harmful microbes found on food spreading to other foods (for example via our hands or kitchen utensils), which then cause illness when those foods are eaten.

One of the key moments for hygiene is when handling and preparing raw foods, particularly poultry. Remember that you should not wash raw chicken or other meats before cooking them, as this can splash microbes onto surfaces or other foods and increase the risk of foodborne illness.

Labels placed on foods are used to determine when it is safe to eat the food, or when the quality of the food is at its best. 'Use by' refers to when the food is still safe to eat. Food should not be consumed after this date. 'Best before' refers to when the food will be at its best quality, but it is worth noting that consumption after this date should still be safe.

Animal and Farm Hygiene

Pet care

Both people and animals carry microbes. Useful microbes, such as those that live in animals' guts contribute to keeping them in good health, while harmful microbes can

make them ill, just like humans. Some infections are restricted to animals, e.g. viral infections that can lead to death, such as feline leukemia in cats and *Parvovirus* in dogs.

Spread of infection

Certain microbes can be transmitted from animals to people and vice versa and result in infections, this is called zoonoses. Ringworm, (a dermatophyte) for example, is an infection that cats and dogs can pass on to people. All sorts of microbes can be spread through dirty hands, and therefore, washing your hands frequently e.g. after looking after or playing with a pet is so important. Conversely, spread of infection from humans to animals is also possible although less frequent: humans can transmit the influenza virus to ferrets and *Staphylococcus aureus* or *Mycobacterium tuberculosis* to dogs.

Prevention of infection

When our pets get an infection, their immune system can help them control the infection without requiring any treatment. To help its immune system to function properly, pets should be well fed with a balanced diet, get regularly dewormed with appropriate medicine, their teeth checked, and their fur brushed and checked for ticks. Pets should be washed with suitable products and provided with their own resting area and bedding, which should be regularly cleaned and disinfected. There are vaccines for animals to prevent certain severe infections such as distemper in dogs and ferrets, *parvovirus* infection, feline leukaemia and influenza, and myxomatosis in rabbits. It is therefore important to get your pet vaccinated by a vet as soon as possible.

Treatment of infections

When our pets are sick, we must take them to the vet. If the infection requires antibiotic treatment, it is important to follow the prescription carefully. Left-over antibiotics

from a previous prescription should never be used. Inappropriate antibiotic use in animals leads, as it does in humans, to bacterial resistance so that the antibiotics become ineffective.

To summarise, to take good care of your pet you should:

- Make sure to check your animal's general and dental hygiene, keep its resting spots clean and don't forget to wash your hands afterwards.
- Feed and de-worm your pet correctly
- See a vet to get your pet vaccinated according to the recommended schedule for the species, and in case your pet is sick
- If the vet prescribes antibiotics, make sure to follow the prescription, and in particular dosage and duration of treatment. Treatment should never be discontinued before the required date even if your pet is better or seems already cured.

Farm Hygiene

Farm animals 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 bacterial species 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 droppings can be found, for example on gates, fences, on the animal's face, etc. N.B. it only takes a small number of these bacteria to cause an infection.

However, there are many more useful microbes on the farm than harmful microbes. These include *Lactobacilli* that ferment silage and turn milk into yoghurt; thermophiles that break down decaying plant matter in compost; and *rhizobia* that change atmospheric nitrogen gas into ammonia in the soil. Some simple steps to

reduce the risk of picking up an infection on a visit to a farm include:

- Washing hands with soap and water after contact with animals and before eating and drinking.
- 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.
- Only 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.

Prevention of Infection: Oral Hygiene

Normally our first teeth come through our **gums** (erupt) at around 6 months of age and we will have a full set of 20 baby (primary) teeth by the time we are 2 ½ years old. At around 6 years old our first permanent molars erupt, and the front primary teeth begin to get wobbly and fall out (exfoliate) and are replaced by adult (permanent) teeth. On average by 12 years old we have lost all of the baby teeth and have 32 adult teeth, which if we look after, can last for the rest of our lives.

Bacteria can grow on teeth, clumping together to form a sticky substance called dental plaque. You will see this in your own mouth as a creamy line around your teeth or sometimes feel it as a furry layer with your tongue. If plaque is not brushed away regularly or there is a high frequency of sugar in the diet, the bacteria within the plaque can lead to tooth decay (caries).

When we eat sugary foods and drinks, bacteria in the plaque can use the sugars to make acid. Over time this can dissolve the outer surface of our teeth (the enamel). As more enamel is dissolved a hole (cavity)

appears. As the decay process continues, the bacteria can reach the nerve and cause toothache.

If no dental treatment is given, the tooth decay (caries) can spread and bacteria can penetrate the nerve, leading to inflammation of the bone and surrounding structures of the tooth which can result in an abscess (lump on the gum) that is filled with pus. This can be very painful and make you feel poorly. The tooth will usually need complex dental treatment or to be removed (extracted). Dental health is extremely important; over 23% of children in England have tooth decay and it is the main reason for children aged 5 to 9 being admitted to hospital. The good news is that tooth decay can be prevented by limiting the number of times we eat foods and drinks with added sugar, brushing twice a day with fluoride toothpaste and regularly seeing the dentist to check the health of our teeth and gums.

Fluoride in toothpaste can help strengthen our teeth and slow down the decay process. The most important time to brush teeth with fluoride toothpaste is before going to bed at night. To make it easy to remember it is best to add tooth brushing to a twice daily hygiene routine morning and night.

Vaccinations

Our immune system generally fights any harmful microbes that may enter our bodies. When we take good care of ourselves (e.g. getting plenty of rest and eating a balanced diet) we help our immune system work properly to prevent infection.

Another means of helping 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.

Most vaccines are injected into the body

but the flu vaccine that is given to most children is a nasal spray. When the vaccine enters the body the immune system detects it and attacks it as if harmful microbes were attacking. White blood cells, a part of our immune system, create lots of antibodies to attach to specific markers on the surface of the vaccine organisms. These markers are called antigens. It takes our immune system around two weeks to learn about the vaccine organisms and while this is happening, we might feel a little tired. This is because the immune system is working hard to kill or eliminate all of the vaccine organisms. 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. This means you develop immunity against diseases.

In some cases, the immune system needs reminding again, 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. Herd immunity is a type of immunity which occurs when a portion of the population (or herd) has received a vaccination or has naturally acquired a particular infection, this provides protection to unvaccinated individuals.

Treatment of Infection:

Antibiotics

The body has many natural defences to help fight against harmful microbes that can cause infection. For example, the skin stops microbes entering the body, the nose has a sticky substance (mucus) which traps microbes if they are inhaled, tears contain substances which can kill bacteria and the stomach produces acid which can kill many microbes if ingested. Generally, by living a

healthy life (eating a balanced diet, 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 to treat diseases caused by bacteria, such as meningitis, tuberculosis and pneumonia. They do not harm viruses or fungi. Some antibiotics stop the bacteria reproducing and others kill the bacteria.

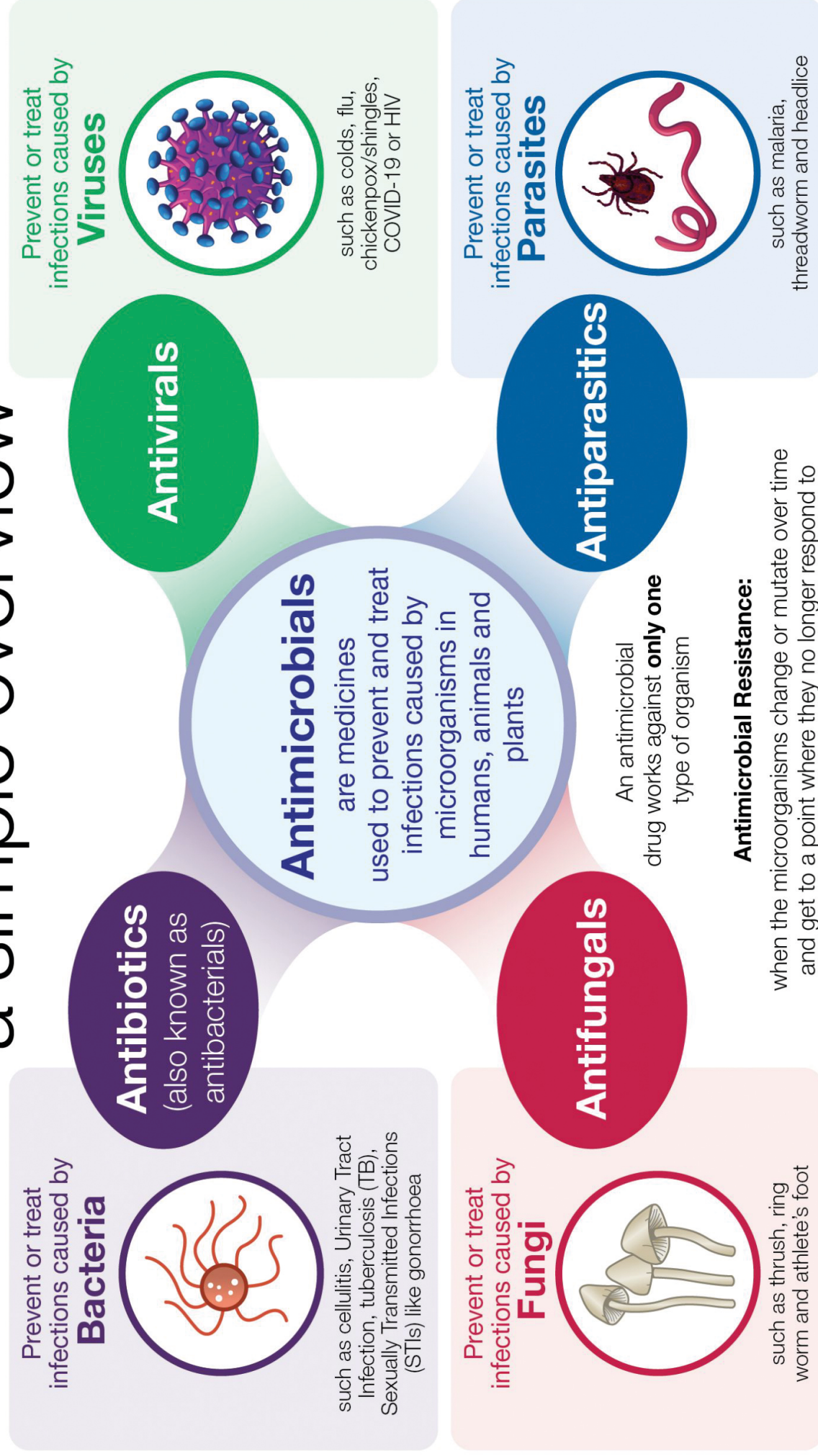
Before antibiotics were discovered, harmful bacteria killed many people. Today however, most bacterial infections are easily treated with antibiotics - but the bacteria are fighting back. Through increased exposure to antibiotics, the bacteria are becoming resistant to them. This is known as antibiotic resistance and 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.



Antimicrobials: a simple overview





Micro-organisms: Introduction to Microbes

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.

Curriculum Links

Science

Working scientifically; Living things and their habitats

PSHE/RSHE

Health and prevention

English

Reading and comprehension

Art & Design

Painting, Recording observations

Key Words

Bacteria, Virus, Fungi, Cell, Germ, Microbe, Probiotic, Microscope

@ Weblink

e-bug.eu/eng/KS2/lesson/Introduction-to-Microbes

Learning outcomes

All students will:

- Understand that bacteria, viruses and fungi are three main types of microbes.
- Understand that microbes are found everywhere.

Most students will:

- Understand that microbes come in different shapes and sizes and are too small to be seen with our eyes.
- Understand that microbes can be beneficial, harmful or both.



Resources Required

Starter Activity: Magazine Microbes

Per student

- ☐ A selection of magazines/ newspapers
- ☐ Crafting materials including:
- ☐ Scissors
- ☐ Glue
- ☐ Colouring pens
- ☐ A3 or large paper to make a collage

Main Activity: Designabug

Per group

- ☐ Copy of SH1
- ☐ Copy of SH2

Per student

- ☐ Copy of SW1
- ☐ Copy of SH4
- ☐ Colouring pencils
- ☐ Stickers for decoration (optional)
- ☐ Googly eyes for decoration (optional)
- ☐ Print stick/ glue (optional)

Extension Activity: What Microbe am I?

Per student

- ☐ Copy of SW2
- ☐ Copy of SH3

Extension Activity: What are Microbes

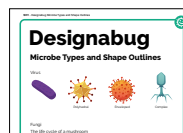
Per student

- ☐ Copy of SW3
- ☐ Copy of SH3

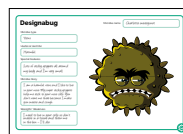
Advance Preparation

1. Prepare a selection of magazines/ newspapers and the materials needed for the starter activity – Magazine Microbes.
2. Download a variety of images of everyday items i.e. shoes, and food from various locations for student viewing.

Supporting Materials



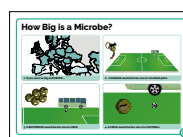
**SH1 Designabug
Microbe shapes**



**SH2 Designabug
Examples**



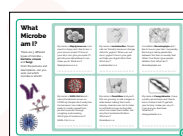
SH3 What are Microbes?



SH4 How Big is a Microbe?



SW1 Designabug



SW2 What microbe am I?



**SW3 What are Microbes
Worksheet**

Lesson Plan



Introduction

1. Begin the lesson by asking students what they already know about micro-organisms. Explain that micro-organisms, sometimes called microbes, germs or bugs, are living things that are too small to be seen with our eyes; they can only be seen through a microscope.
2. Show the students that there are three main types of microbes: bacteria, viruses and fungi. Use the colour handout provided as SH1 to see example microbes.
3. Explain that microbes are so small that they can only be seen through a microscope. Provide students with SH4 How Big is a Microbe to demonstrate the different sizes of microbes.
4. 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.
5. Explain to the students that some diseases called infections are caused by microbes. Ask the children if they, or anyone in their family, have ever been sick? What was the disease and what do they think caused it?
6. Emphasise that although some microbes cause disease, there are also microbes that can be very useful. Ask students to identify some useful microbes. If they cannot, provide examples for them e.g. *Lactobacillus* in yoghurt and probiotics drinks, Penicillin from fungi, yeast in bread, etc.

Discussion

At the end of the activity, explain to the participants that microbes are found everywhere even on the magazine they were looking through. Stress that microbes are found all over our skin, mouth, gut and hands. Most are completely harmless that we carry without knowing.

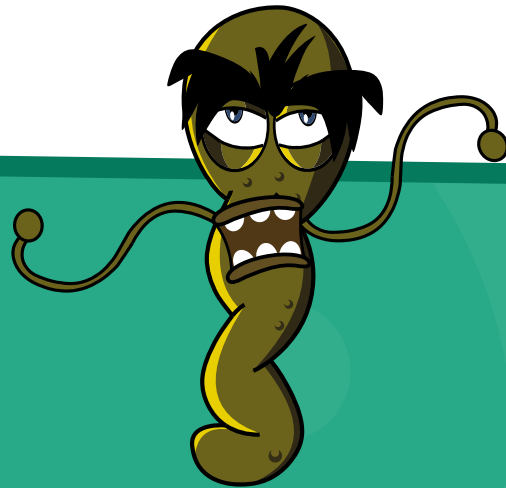
Discuss that the bacteria on our bodies are important as they act as a barrier to stop other more harmful bacteria entering your body and making you ill.

Main Activity: Designabug

1 Choose what microbe you want to be (a bacteria, virus or fungi)

2 Add more detail to your microbe e.g. shape, useful or harmful microbe

3 Name your microbe



Starter Activity: Magazine Microbes (10-20 mins)

This activity can be carried out either individually or in groups.

1. Provide the students with magazines.
2. Ask students to look through the magazines and find images of places where microbes can be found (i.e. a picture of a fridge, people, kitchen worktop, shoes, clothes etc.)
3. Ask students to cut out the images using scissors and stick onto an A4 piece of paper to make a collage with the title "Where can microbes be found?"
4. If time permits and students are comfortable to they can present their posters to the rest of the group.

This will help students understand that microbes are found everywhere.

Main Activity: Designabug

This activity allows students to explore the different types of microbes present in the world by designing their own microbe. An example of the activity can be found in SH2.

Provide each group with SH1 and each student a copy of SH2.

1. Ask students to decide which microbe bacterium, a virus, or a fungus they want to design.
2. And then decide which microbe shape they would like it to be. Use SH1 to help choose a microbe and shape, and SH4 to help students understand the scale of microbes.
3. Ask students to decide whether they want their microbe to be a useful or harmful microbe. This will help students understand that microbes are found everywhere.

4. Ask students to add some details to their microbe depending on whether they've chosen a useful or harmful microbe to design, this could be eyes, a smile, big bushy eyebrows or long wobbly arms.
5. Ask students to give their microbe at least two special features and a strength or weakness.
6. Ask students to provide a backstory about their microbe, this could include where this microbe lives and what they like to do.
7. Finally, ask students to name their microbe, this could be a combination of their own name and the microbe shape.

At the end of the activity provide students with examples of realist microbes so they can compare their own designed microbes with real microbes that exist in the world. You can use SH1 for real microbe examples.

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'

Extension Activities

What Microbe am I?

Provide each participant with a copy of SW2 and SH3. Ask students to read the descriptions and using the information on SH3 students should decide whether the microbes are bacteria, virus or fungi.

SW2 Answers:

- a *Staphylococcus* is a bacterium.
- b *Lactobacillus* is a bacterium.
- c Dermatophytes are fungi.
- d SARS-CoV-2 is a virus.
- e *Penicillium* is a fungus.
- f *Campylobacter* is a bacterium

What are Microbes?

Fill in the Blanks Worksheet

Provide each student with a copy of SW3. Ask students to fill in the blanks using the correct words provided. Students can complete this in class or as a homework activity.

Learning Consolidation

At the end of the lesson, ask the class the questions below to check understanding:

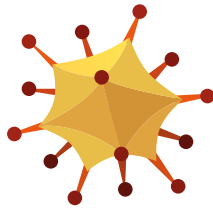
- ☐ What are 3 main types of microbe?
Answer: Bacteria, viruses and fungi
- ☐ All microbes can be seen by the naked eye, True/False?
Answer: False
- ☐ On what objects can microbes be found?
Answer: Microbes are found everywhere
- ☐ Are microbes useful, harmful or both?
Answer: Both
- ☐ Or write your own.



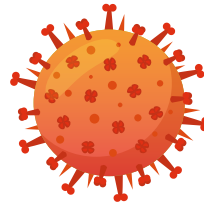
Designabug

Microbe Types and Shape Outlines

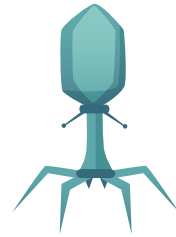
Virus



Polyhedral



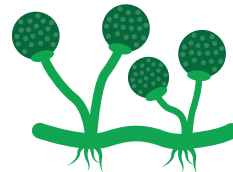
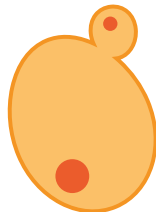
Enveloped



Complex

Fungi

The life cycle of a mushroom



Bacteria



coccus



diplococci



streptococci



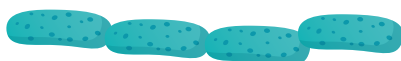
Staphylococci



bacillus



diplobacilli



Streptobacilli



Vibrio



Corkscrew's form
Borrelia burgdorferi





Designabug

Microbe type

Virus

Useful or Harmful

Harmful

Special Features

Lots of sticky grippers all around my body and I'm very small

Microbe Story

I am a harmful virus and I like to live in your nose. My super sticky grippers help me stick to your nose cells. You don't want me there because I make you sneeze and cough.

Strength/ Weakness

I need to live in your cells so don't sneeze in a tissue and throw me in the bin - I'll die.

Charlotte sneezyshot

Microbe name



What are Microbes?

- Microbes are living organisms
- They are so small we need a microscope to see them
- They come in different shapes and sizes
- They are found EVERYWHERE!
- Some microbes are useful or even good for us
- Some microbes can make us ill

There are 3 different types of microbes:

VIRUSES



Influenza



Viruses are even smaller than bacteria and can sometimes live **INSIDE** bacteria.

Some viruses make us sick.

Diseases like **CHICKENPOX** and the **FLU** are caused by viruses.

Viruses can spread from one person to another but it depends on the type of virus.

BACTERIA

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

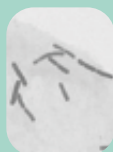
Spirals

(*Campylobacter*)



Rods

(*Lactobacillus*)



Balls

(*Staphylococcus*)



Bacteria are so small that 1000s could fit on the full stop at the end of this sentence.

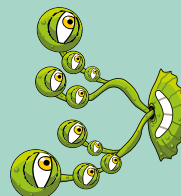
Some bacteria are helpful in cooking, for example, making yoghurt and cheese.

Some bacteria are harmful and cause infection.

Bacteria multiply very fast.

FUNGI

Penicillium



Dermatophyte



Fungi are the largest of all microbes.

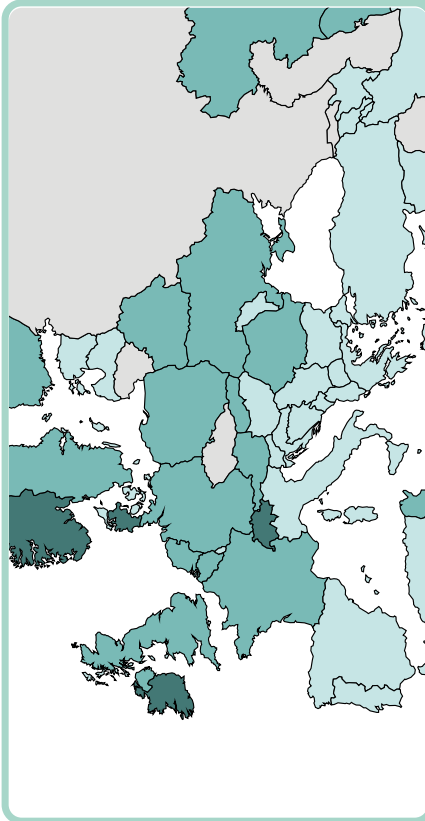
Fungi can be found in the air, on plants and in water.

Mould, which grows on bread, is a type of fungus.

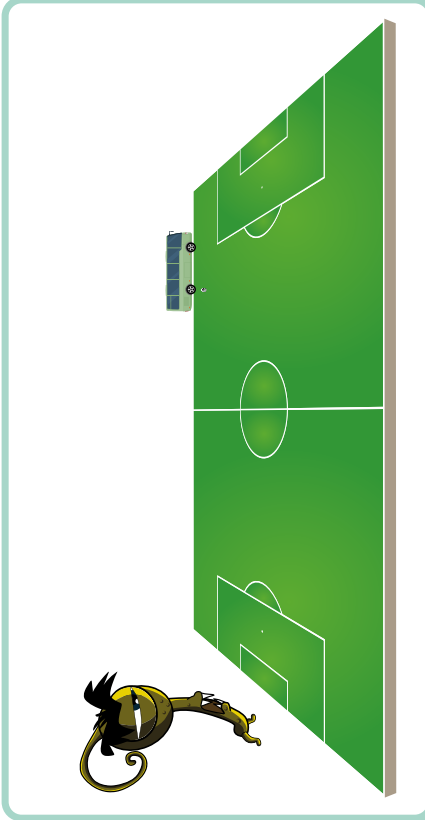
Some antibiotics are made by fungi.



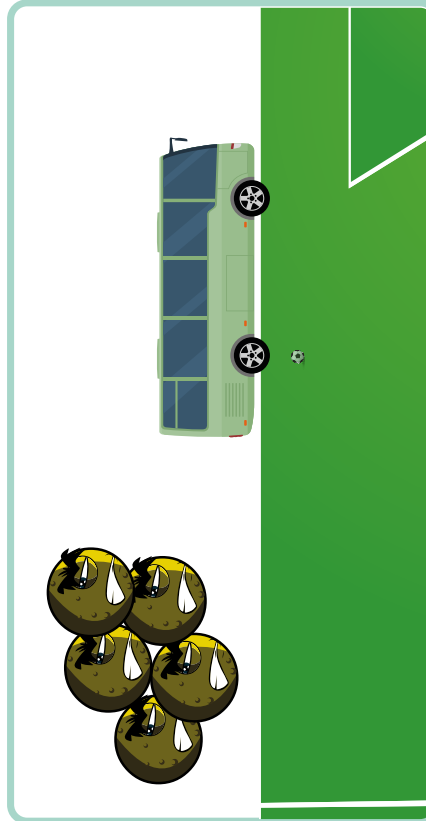
How Big is a Microbe?



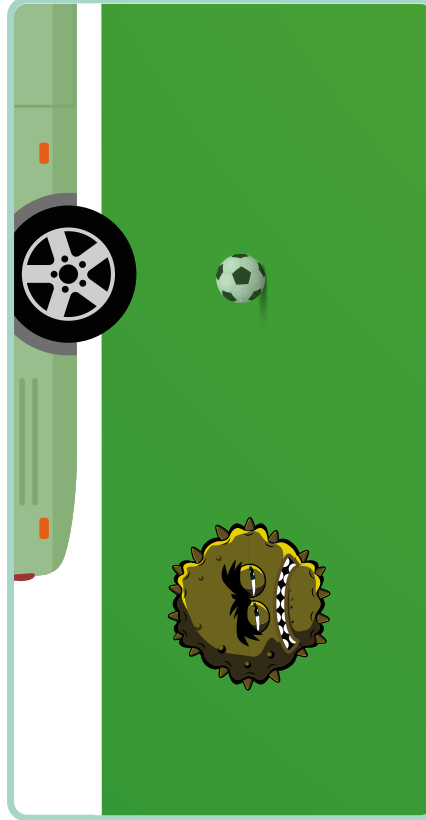
1. If you were as big as EUROPE...



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





Designabug

Microbe Name

Microbe Type

Useful or Harmful

Special Features

Microbe Story

Strength/Weakness

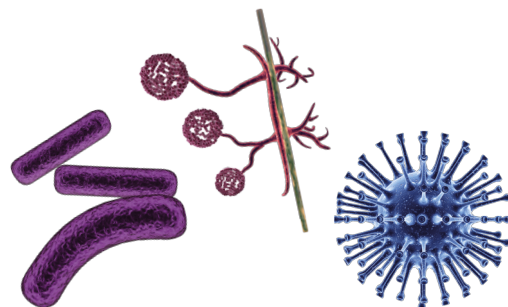




What Microbe am I?

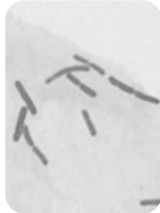
There are 3 different types of microbe – **bacteria, viruses** and **fungi**.

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



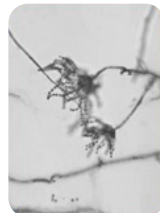
My name is **Staphylococcus**. I am round in shape and I like to live in your nose or armpit. If I live on your skin I can give you spots. If I get into your bloodstream I can make you ill. What am I?

Staphylococcus is a:



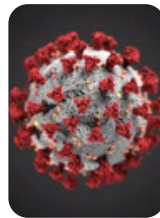
My name is **Lactobacillus**. People call me 'friendly' because I change milk into yoghurt. When you eat me in yoghurt I live in your guts and help you digest other food. What am I?

Lactobacillus is a:



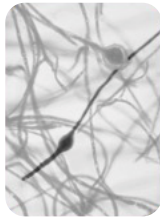
My name is **Penicillium** and you'll find me growing on old oranges or stale bread making them look mouldy. Humans use me to make an antibiotic known as Penicillin which can make them better, but only from bacterial infections. What am I?

Penicillium is a:



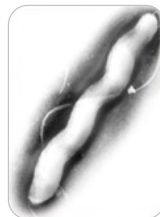
My name is **SARS-CoV-2** and I cause the disease known as COVID-19. People don't really like me because I can make them really ill. I easily spread from person to person through coughing and sneezing. What type of microbe am I?

SARS-CoV-2 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 **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:

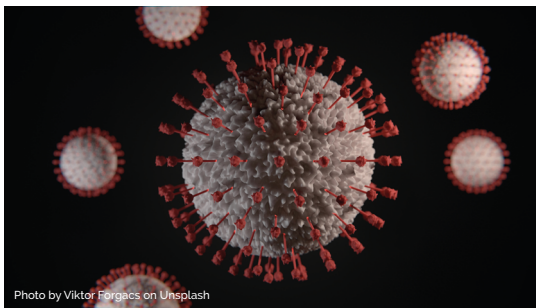




What are Microbes

_____, more commonly known as germs, bugs or microbes, are tiny living things too small to be seen with the naked eye. They are found almost everywhere on earth.

Some microbes are useful, and others can be harmful to humans. There are _____ main groups of microbes:



_____ are the smallest of the three microbes described and can be harmful to humans. Viruses cannot survive by themselves. They need a 'host' cell in order to survive. Once inside the host cell, they rapidly multiply and destroy the cell in the process. One type of virus is SARS-CoV-2.

Fungi are the **largest** of the three microbes described and are multi-cellular organisms (made up of more than one cell). Some fungi are useful, and some can be harmful to humans. For example, *Saccharomyces* is a _____ that is used to help bread rise.

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

Words to use: viruses, pea, micro-organisms, single-celled, three, yeast





Micro-organisms: Useful Microbes

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

Curriculum Links

Science
Working scientifically

PSHE/RSHE
Health and prevention

English
Reading and comprehension

Key Words

Culture, Fermentation, Probiotics

@ Weblink

[e-bug.eu/eng/KS2/lesson/
Useful-Microbes](https://e-bug.eu/eng/KS2/lesson/Useful-Microbes)

Learning Outcomes

All students will:

- Understand that some microbes can help keep us healthy.
- Understand that some microbes can be put to good use.
- Know that microbes grow at different rates depending on their environments.



Resources Required

Main Activity: Yeast races

Per student

- ☐ 2 plastic cups
- ☐ Flour
- ☐ Yeast solution
- ☐ Sugar
- ☐ 2 Graduated cylinders (or measuring jugs)
- ☐ Basin
- ☐ Hot water
- ☐ Teaspoon

Per student

- ☐ Copy of SH1
- ☐ Copy of SW1

Extension Activity: Fill in the Blanks

Per student

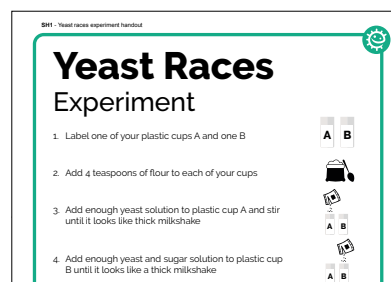
- ☐ Copy of SW2

Advance Preparation

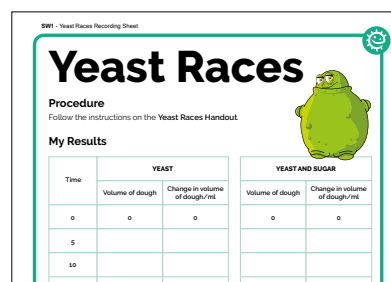
Purchase flour, sugar and dried yeast. Prior to starting the activity make up a liquid yeast solution as outlined on pack purchased. This may vary between different brands. If made too far in advance the yeast will start to ferment.

NB: do NOT add sugar until stated in the main activity.

Supporting Materials



SH1 Yeast Races Experiment Handout



SW1 Yeast Races Recording Sheet



SW2 Useful Microbes Fill in the Blanks Worksheet

Lesson Plan



Introduction

1. Begin the lesson by explaining that microbes can have both harmful and useful effects on our health. Ask the class what they know about useful or 'friendly' bacteria. Many students will have already heard about probiotic bacteria in yoghurt.
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 yoghurt, 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 produces gas and acids. These acids change the taste, smell and form of the original foodstuff whereas the gas makes the dough rise.
4. Tell the class that in this activity they are going to see exactly how we can use useful microbes to make bread rise.

Discussion

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 produces gas bubbles which cause the dough to rise.

Start a classroom discussion on how microbes keep us healthy

- b. What would have happened if there were no live yeast in the mixture?

Nothing, it's the growing yeast that causes the breakdown of sugars and makes the dough rise.

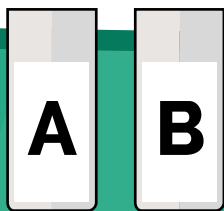
- c. Why was the mixture kept in a basin of warm water?

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 mixture will rise up the cylinder.

- d. What other food products are made using bacteria or fungi?
- Cheese, bread, wine, beer, sour cream.*

Main Activity: Test Races

1 Label 2 cups A and B. Add 4 teaspoons of flour to each cup



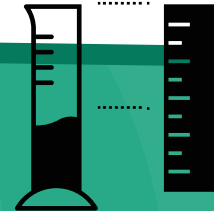
2 Add yeast to cup A and mix



3 Add yeast and sugar to cup B and mix



4 Pour each cup into cylinders and measure the height of the dough



Main Activity: Yeast Races

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 through a process called fermentation.
3. Supply the class or groups with the Yeast Races Recipe (SH1).
4. Ask students to 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 (SW1).
5. Can the class explain why the yeast and sugar solution moved faster than the yeast alone? Students should recognise that fermentation was carried out at a faster rate when the sugar was present.

Fascinating Fact

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



Extension Activity

Microbes and Food

Fill in the Blanks Worksheet

Provide students with SW2 and ask them to fill in the blanks using the correct words provided. This can be completed in the classroom or as a homework exercise.

SW2 Answers:

1. Fermentation
2. *Lactobacillus bulgaricus*
3. Yoghurt
4. Bread
5. Yeast
6. Air (CO₂)

Learning Consolidation

At the end of the lesson, ask the class the questions below to check understanding:

- ☐ Do microbes have both useful and harmful effects on our health.

Answer: Yes

- ☐ Some microbes can help keep us healthy True/False?

Answer: True

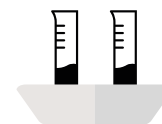
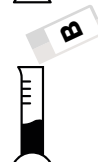
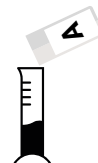
- ☐ Some microbes can be put to good use in the food industry. List five food or drink items.





Yeast Races Experiment

1. Label one of your plastic cups A and one B
2. Add 4 teaspoons of flour to each of your cups
3. Add enough yeast solution to plastic cup A and stir until it looks like thick milkshake
4. Add enough yeast and sugar solution to plastic cup B until it looks like a thick milkshake
5. Pour the contents of cup A into graduated cylinder A until it reaches about 30ml
6. Pour the contents of cup B into graduated cylinder B until it reaches about 30ml
7. Record the exact height of the dough in each cylinder
8. Place both measuring cylinders into a basin of hot water
9. Measure the height of the dough every 5 minutes for 30 minutes



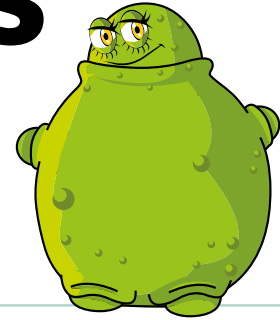


Yeast Races

Procedure

Follow the instructions on the Yeast Races Handout.

My Results



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

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

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?

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 of friendly bacteria in the average human gut.





Microbes

Microbes are single-celled organisms, most of which are useful, although some of them cause illness and disease. One of the main ways in which microbes are useful is in the food industry. Cheese, bread, yoghurt, chocolate, vinegar and alcohol are all produced through the growth of microbes. The microbes used to make these products cause a chemical change known as _____ a process by which the microbes break down the complex sugars into simple compounds like carbon dioxide and alcohol. Fermentation changes the product from one food to another.



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

Lactobacillus 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 _____ and probiotic drinks.

Yeast, ***Saccharomyces cerevisiae***, is used to make _____ and _____ 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 _____ which get trapped in the dough and the lump of dough expands.

Words to use: *Lactobacillus bulgaricus*, bread, air (CO₂), fermentation, yeast, yoghurt





Micro-organisms: 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, wordsearch and quiz.

Curriculum Links

Science

Working scientifically

PSHE/RSHE

Health and prevention

English

Reading and comprehension

Key Words

Bacteria, Fungi, Germs, Infection,
Pathogens, Virus

@ Weblink

[e-bug.eu/eng/KS2/lesson/
Harmful-Microbes](http://e-bug.eu/eng/KS2/lesson/Harmful-Microbes)

Learning Outcomes

All students will:

- Understand that sometimes microbes can make us ill.
- Understand that harmful microbes can pass from person to person.
- Understand that not all illnesses are caused by harmful microbes.



Resources Required

Starter Activity: Class discussion

Per class

- ☐ Copy of TS1
- ☐ Copy of SH1
- ☐ Copy of SH2

Main Activity: Mould bread experiment

Per group

- ☐ 3 slices of bread
- ☐ Water
- ☐ Marker
- ☐ 3 resealable plastic bags

Extension Activity 1: Most Wanted Poster

Per student

- ☐ A4 paper
- ☐ Colouring pens/pencils

Extension Activity 2: Bad Bug Challenge

Per student

- Copy of SW1**

Extension Activity 3: True or False Flashcards

Per student

- Copy of SH3

Extension Activity 4: Harmful Microbes Quiz

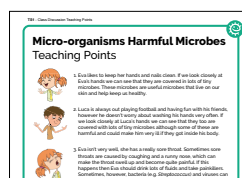
Per student

- ☐ Copy of SW2

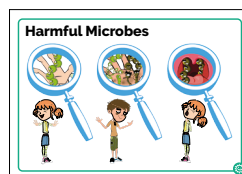
Health and Safety

Bags must not be opened to provide a closer look at the surface of the bread; this could release fungal spores which could be inhaled and cause respiratory distress. The three bags should be placed, unopened, in the normal waste or in a food waste recycling collection.

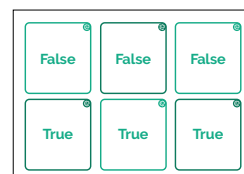
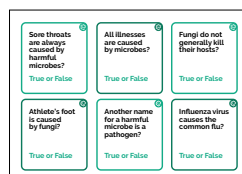
Supporting Materials



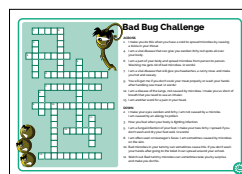
TS1 Class Discussion Teaching Points



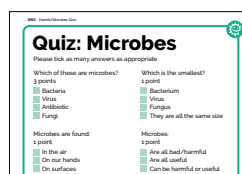
SH1 & SH2 Class Discussion: Picture Scenarios



SH3 Harmful Microbes True/False Flashcards



SW1 Harmful Microbes Crossword and Wordsearch



SW2 Harmful Microbes Quiz

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 a pathogen is a 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.
3. Highlight to the class that microbes have adapted to live everywhere, such as in our classrooms, houses, bedrooms, all over our body and on food.
4. Tell the class that harmful disease causing microbes can spread easily from one person to another and are called infectious diseases because they can cause an infection.
5. Some good news – tell the class that our bodies have our own 'useful' microbes that try to stop the harmful pathogens from causing an infectious disease.

Discussion

a. What causes an infection?

An infection happens when harmful microbes get inside your body and replicate, causing the infected person to get ill. This can happen very quickly or can take a long time.

Check for understanding by asking the students the following questions:

b. Are sore throats always caused by harmful microbes?

Not all sore throats are caused by harmful microbes, sometimes coughing or having a toothache can cause our throats to become red and sore too.

c. Are all illnesses caused by microbes?

Illnesses caused by microbes are known as infectious diseases. There are also illnesses, such as asthma and hay fever, that are not caused by microbes. These are known as non-infectious diseases.

d. Can you think of any infections caused by harmful microbes?

Athlete's foot, influenza, measles.

Main Activity: Mould Bread Experiment

1 Place 3 slices of bread into separate sealable bags and label 1 to 3

2 Add water to one bag and put it in a dark place

3 Put the second bag in a bright sunny place

4 Put the third bag in the refrigerator

5 Wait at least one week



Starter Activity: Class Discussion with Scenario Prompts

This activity is best suited as a class discussion.

1. Show the class SH1 and SH2 which can be displayed on a whiteboard.
2. Discussion points 1-6 in TS1 match the 6 images displayed in SH1 and SH2 and provide scenarios to prompt discussion.
3. Begin a discussion by asking students to consider the character's actions and how microbes may be affecting them.
4. Continue the discussion by asking if anyone in the class has ever suffered from any of these symptoms and if so, what kind of treatment they had.

Remember: Hand washing, respiratory and food hygiene activities are covered in more detail later in the pack.

Main Activity: Mouldy Bread Experiment

Mould spores just need the right environment to grow and flourish. In this experiment, students will learn the conditions that speed up mould growth on bread.

1. Place a slice of bread in each plastic bag and seal properly. Number each bag with a marker.
2. Add some water to bag 1. Put it in a dark place.
3. Put the second bag in a bright sunny place.
4. Put the third bag in the refrigerator.
5. Check each bag for a week.
6. Examine the slices of bread and ask students what they expect to see.
7. At the end of the week ask students to record their results. Are they what they expected?

At the end of the week, each bag will have a different kind of mould growth. In a bright, sunny place, the temperature is highest which would encourage faster/greater mould growth. In the refrigerator, the low temperature would limit the amount of growth, if at all. The bread stored in the dark, damp conditions should have the most mould growth. Students will learn that mould tends to grow faster in warm, wet conditions. Mould growth could also be intermediate between the slices.

Fascinating Fact

Did you know that there are more microbes on the planet than any other species of living thing?

Extension Activities

Most Wanted Poster Design

Asks students to make a 'Most Wanted' style poster for a harmful micro-organism e.g. Influenza virus, *Campylobacter*, dermatophyte fungi, *Salmonella*.

Posters should include: a drawing of the harmful micro-organism, a description, including how it infects humans, where it can be found and symptoms (if applicable).

True/False Flashcards

SH3 includes a set of questions and true/false answer cards for the students. In groups of 3 or 4 ask students to raise the cards to answer each of the questions.

SH3 Answers:

1. Sore Throats are always caused by harmful microbes?
Answer: False
2. Athlete's Foot is caused by fungus?
Answer: True
3. All illnesses are caused by microbes?
Answer: False
4. Another name for a harmful microbe is a pathogen?
Answer: True
5. Fungi do not generally kill their hosts?
Answer: True
6. Influenza virus causes the common flu?
Answer: True

Bad Bug Challenge

SW1 provides a fun crossword and word search. Students can complete the tasks individually or in pairs to consolidate the lesson. Answers are available on the e-Bug website.

Microbes Quiz

SW2 provides another fun way to consolidate learning. Allocate students to groups of 3 or 4 and provide one sheet per team. The team with the most points wins.

SW2 Answers:

1. Bacteria, virus, fungi
2. Everywhere
3. Cheese, bread and yoghurt
4. Pathogen
5. Virus
6. Can be useful or harmful
7. Pathogen
8. All of the above

Learning Consolidation

At the end of the lesson, ask the class the questions below to check understanding:

- ☐ Some microbes can be harmful to humans and can cause disease.
Provide one example:
- ☐ Which microbe is very small causes coughs, colds, sore throats and flu?
Answer: Viruses
- ☐ Provide two ways that harmful microbes can spread from person to person.



Micro-organisms Harmful Microbes

Teaching Points



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



2. Luca 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 Luca's hands we can see that they too are covered with lots of tiny microbes although some of these are harmful and could make him very ill if they got inside his body.



3. Eva isn't very well, she has a really sore throat. Sometimes sore throats are caused by coughing and a runny nose, which can make the throat swell up and become quite painful. If this happens then Eva 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.



4. In this picture, do you think that Luca is ill because of microbes? The answer is no, Luca 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.



5. What do you think is wrong with Luca in this picture? Poor Luca 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.

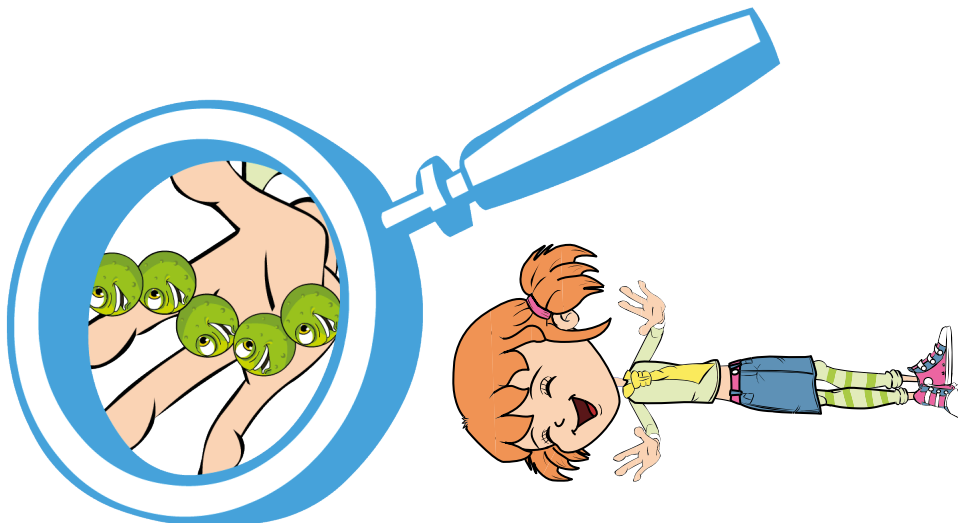
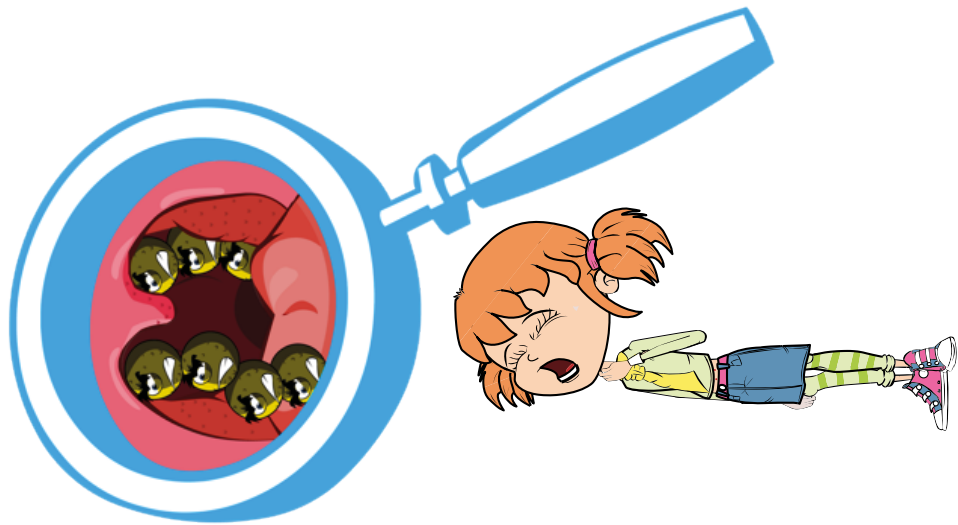


6. Eva plays tennis and she has sweaty, smelly feet. She is always in a hurry so she doesn't wash or dry her feet properly. Her feet smell and are also very itchy and swollen in between her toes. This is because fungi known as dermatophytes like to live between the toes, especially if they are damp.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



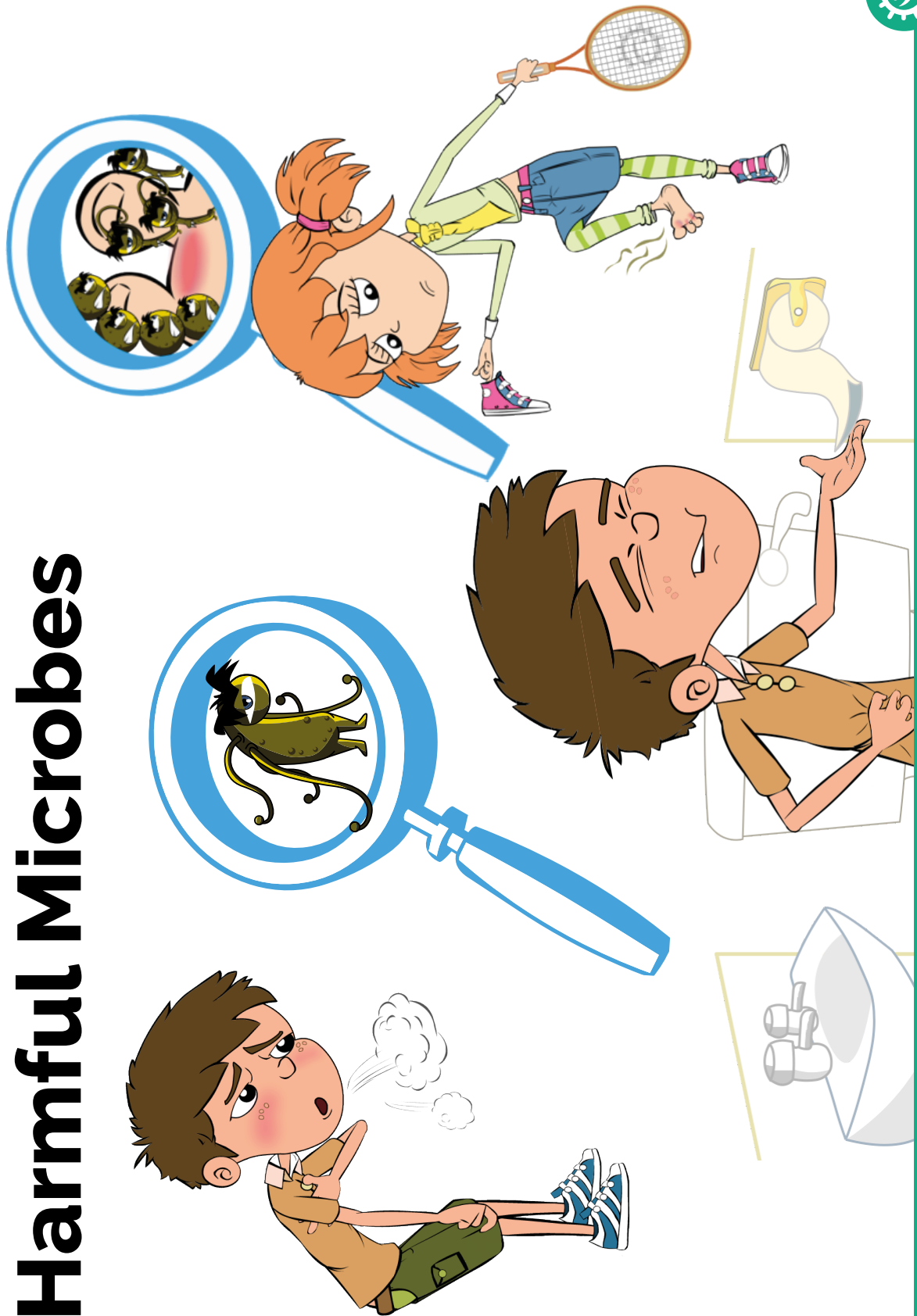


Harmful Microbes





Harmful Microbes





Fungi do not generally kill their hosts?

True or False



Influenza virus causes the common flu?

True or False



All illnesses are caused by microbes?

True or False



Another name for a harmful microbe is a pathogen?

True or False



Sore throats are always caused by harmful microbes?

True or False



Athlete's foot is caused by fungi?

True or False





False



True



False



True



False

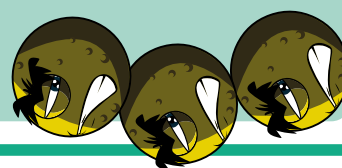
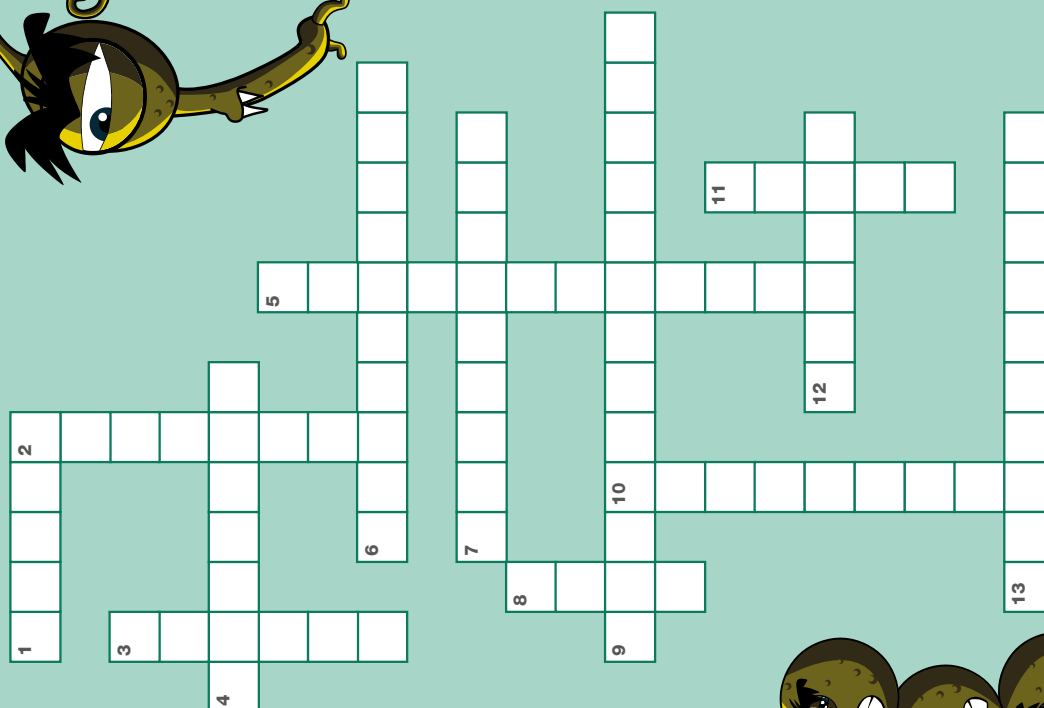


True





Bad Bug Challenge



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. (2 words)
7. I am a viral disease that will give you headaches, a runny nose and 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. (2 words)
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 an allergy to 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 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.



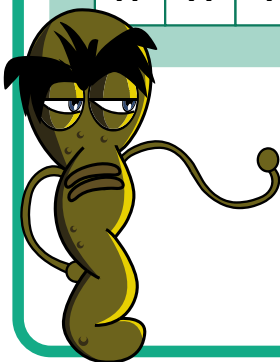


Bad Bug Challenge

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



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



COUGH
COLD
FOOD POISONING
DIRTY HANDS
HEADACHE

HAYFEVER
ASTHMA
SPOT
FLU
INFLUENZA

ATHLETES FOOT
SLEEPY
MEASLES
VOMIT





Quiz: Microbes

Please tick as many answers as appropriate

Which of these are microbes?

3 points

- ☐ Bacteria
- ☐ Virus
- ☐ Antibiotic
- ☐ Fungi

Which is the smallest?

1 point

- ☐ Bacterium
- ☐ Virus
- ☐ Fungus
- ☐ They are all the same size

Microbes are found:

1 point

- ☐ In the air
- ☐ On our hands
- ☐ On surfaces
- ☐ Everywhere

Microbes:

1 point

- ☐ Are all bad/harmful
- ☐ Are all useful
- ☐ Can be harmful or useful
- ☐ Have no effect on the human body

Which foods or drinks are produced through the growth of microbes?

3 points

- ☐ Cheese
- ☐ Bread
- ☐ Yogurt
- ☐ Fizzy drinks

Which of these microbes causes the common cold?

1 point

- ☐ Bacteria
- ☐ Virus
- ☐ Antibiotic
- ☐ Fungi

What is another word for a harmful microbe?

1 point

- ☐ Infectious
- ☐ Antibiotic
- ☐ Pathogen
- ☐ Flora

Which of these are shapes of microbes?

1 point

- ☐ Rods
- ☐ Balls
- ☐ Spirals
- ☐ All of the above





Spread of Infection: Hand Hygiene

By taking part in 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.

Curriculum Links

Science

Working scientifically, Living things and their habitats, Animals, including humans

PSHE/RSHE

Health and prevention

English

Reading and comprehension

Design & Technology

Cooking and nutrition

Art & Design

Painting, Recording observations

Key Words

Bacteria, Hygiene, Infection, Microbe, Soap, Transfer

@ Weblink

e-bug.eu/eng/KS2/lesson/Hand-Hygiene

Learning Outcomes

All students will:

- Understand that infection can be spread through unclean hands.
- Understand that hand washing can prevent the spread of infection.
- Understand when and how to wash hands.

Most students will:

- Understand why we should use soap to wash our hands.
- Understand that washing hands is one of the best ways to prevent the spread of microbes.

Resources Required

Main Activity: Healthy hands *Per group*

- ☐ Copy of SH1
- ☐ Copy of SH2
- ☐ Basin (or sink)
- ☐ Hand soap
- ☐ Paper towels
- ☐ Pens
- ☐ Water
- ☐ Oil based UV gel or powder and UV lamp or cooking oil and cinnamon/eco-friendly glitter

Per student

- ☐ Copy of SW1
- ☐ Copy of SW2

Activity 2: What have we missed *Per group*

- ☐ Copy of SH2
- ☐ Blank paper
- ☐ Finger or body paints (non-toxic and washable)
- ☐ Smocks/aprons to cover clothing for younger groups
- ☐ Hand washing facilities or basin with soap and water
- ☐ Paper towel for drying hands

Extension Activity 1: **Fill in the Blanks** *Per student*

- ☐ Copy of SW3

Extension Activity 2: **Hand Hygiene Quiz** *Per group*

- ☐ Copy of SW4

Extension Activity 3: **Sequencing Activity** *Per student*

- ☐ Copy of SH3

Advance Preparation

Main Activity: Healthy Hands

1. Arrange four desks side by side for the 4 stations. Each desk should contain one of the following:
 - a. A sign reading 'No hand washing'
 - b. A basin of water, paper towels and a sign reading 'Wash for 3 seconds'
 - c. A basin of water, paper towels and a sign reading 'Wash for 20 seconds'
 - d. A basin of water, hand soap, paper towels and a sign reading 'Wash in Water and Hand Soap for 20 seconds'

Activity 2: What have we Missed?

For each student prepare:

1. Smock or shirt to cover clothing
2. A small dollop of finger paint
3. Basin with water and soap if hand washing facilities not available (could be used for group of 2-3)

Supporting Materials



SH1 How Clean are Your Hands



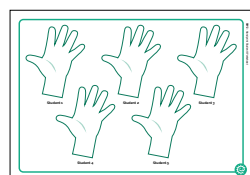
SH2 Hand Washing Poster



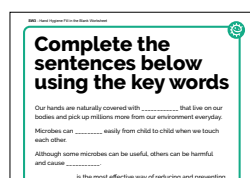
SH3 Washing Your Hands Sequencing Activity



SW1 Student Recording Sheet



SW2 Hand Print Student Worksheet



SW3 Hand Hygiene Fill in the Blank Worksheet



SW4 Hand Hygiene Quiz

Health and Safety

1. If social distancing does not allow students to shake hands, gel could be transferred by having students touch objects and see how the gel transfers from hands to surfaces (or vice versa), with the hand washing and cleaning of objects to follow. If appropriate, this can be combined with a PE game where you cover a ball/baton with gel, play a game and then show the students how the gel from the object has spread around by the room by touch.
2. It is essential to ensure that use of the lamp is supervised and that pupils place their hands under the UV radiation for as short a time as possible. It is also vital that pupils do not stare directly at the UV lamp; the eyes are most at risk from extended viewing of UV radiation. Depending on the design of the UV lamp that is available, it should be held firmly, for example with retort stands and clamps, so that the radiation shines downwards onto the bench and that the lamp cannot be moved and shone into pupils' faces.

Modifications

1. If UV gel or powder and a UV lamp are unavailable, ask the students at the front to cover their hands in cooking oil or an equivalent non-harmful oil and sprinkle well or cover with cinnamon or eco-friendly glitter.
2. Students with additional needs: The use of eco-friendly glitter allows the students to feel the 'microbes' on their skin. It might help students if you demonstrate what will happen in this activity.

Lesson Plan



Introduction

1. Begin the lesson by asking how many students have washed their hands today. Ask them why they washed their hands (to wash away any dirt or microbes that might be on their hands) and what would happen if they didn't wash away the microbes (they might get ill if any harmful microbes from their dirty hands gets in their mouth or an open cut, or they could pass them on to someone else).
2. Tell the students that we use our hands all the time, they are naturally covered with microbes that live in our bodies and pick up millions of microbes from the environment every day. Although many of these microbes are harmless, some could be harmful. Explain to the students that we spread microbes to our friends and others through touch, and this is why we wash our hands. One study found that people touch their face 23 times per hour, about 280 times a day. Explain that touch is an important sense to give information to our brain, but we should be aware of how easy it is to spread microbes when our hands are dirty.
3. Explain to students that they are going to carry out an activity to show how best to wash their hands with soap and water and remove any of the harmful microbes which may be on their hands.

Discussion

Lead the discussion to reflect on the learning objectives:

1. Microbes spread very easily from you to other people.
2. The best way to stop harmful microbes spreading to others is by washing our hands.
3. Use soap when washing hands, and wash all parts of our hands, including thumbs. Remember not to splash and dash! Use a song of your choice to time your hand washing.
4. If soap and water isn't available, hand sanitiser is also effective. You should apply following the six steps and allow to air dry.

Discuss what the group have learnt today with open questions:

What have you learnt today?
How has the activity changed the way you wash your hands?
When is it important to wash your hands?

Main Activity: Healthy Hands

1 Split into 4 groups: no hand washing, washing hands in water for 3 and 20 seconds, washing hands with soap and water for 20 seconds and stand in a row

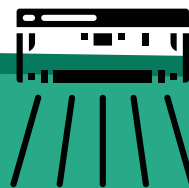
2 The person in front, cover your hands with UV gel or powder



3 Person 1, shake hands with person 2 in your group

4 Person 2, shake hands with person 3 and so on

5 Look at your hands under a UV lamp



Main Activity: Healthy Hands

1. Divide the class into four equal groups.
2. Ask each student to stand in a row one behind the other and assign groups as follows:
 - a. No hand washing
 - b. Wash hands in water for 3 seconds
 - c. Wash hands in water for 20 seconds
 - d. Wash hands in water with soap for 20 seconds
3. Ask the first person in each group to close their eyes and cover their hands in UV gel or powder. This is to avoid students washing their hands more thoroughly than they usually would. Ask the lead person to wash their hands according to the group they are in.
4. Once completed, they should open their eyes, 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. Students should notice the difference in the number of microbes on the hands of students in different groups.
6. Ask students to complete SW1 to record the results of the experiment. Provide students with SW2 and ask them to colour the hands to replicate the results of the experiment. SH1 can be used as a guide.
7. Ask students to follow a teacher demonstration of the six-step hand washing technique using SH2 six steps poster. Ensure that students thoroughly wash their hands with soap and water.

8. Explain that hand sanitiser can be applied using the same steps but then needs to be allowed to dry and is not washed off like soap. Remember to shake the UV gel or powder before starting and to change the water if it starts to get murky.

Activity 2: What have we Missed?

1. Ask students to wear the protective clothing and sit down.
2. Explain students will learn the best way to wash their hands to remove germs by pretending that paint is soap.
3. Put a small squirt of paint in each of the student's hands. Ask the groups to close their eyes and pretend they are washing their hands. Only give them about 5 seconds to do this and explain that this is to see what happens if we wash our hands for too short a duration.
4. Ask students to open their eyes and hold up their hands.
5. Discuss what part of their hands is missing the soap. Ask them how they think they could make sure that all their hands are covered with soap, so the germs can be washed away/killed.
6. Use the six steps of hand washing poster (SH2) to explain how to wash hands and for how long. Hand sanitiser can be applied using the same steps but then needs to be allowed to dry.
7. At this point students may want to make hand prints on a blank piece of paper.
8. Have the students 'wash' with the paint on their hands again (may need to provide additional paint) and see if they cover more of their hands with the soap when they follow the six steps. They can make additional hand prints if desired.
9. Repeat the six-step hand washing technique.

Extension Activities

Fill in the Blanks

Provide students with SW3 and ask them to fill in the blanks using the correct words provided. Students can complete this activity individually in the classroom or as homework. Answers are available on the e-Bug website.

Hand Hygiene Quiz

SW4 is a fun consolidation quiz. Allocate students to groups of 3 or 4 and provide one quiz sheet per team. The team with the most points wins. Answers are available on the e-Bug website.

Sequencing Activity

Students can use SH2 as a guide to order the cards in SH3. Ask students to place the cards in the correct hand washing order as a useful way to support learning.

Learning Consolidation

At the end of the lesson, ask the class to answer the following questions.

- ☐ What song will you choose to use when washing your hands?
- ☐ How many steps are there to wash every part of your hands?

Answer: Six steps

- ☐ What are the key moments in the day that you must wash your hands?

Answer: Before eating, after using the toilet, after touching animals, after coughing, sneezing or blowing your nose, if you are ill or have been around ill people, when you get home or go into another place like school

- ☐ What can you use if you are not able to wash your hands with soap and water?

Answer: Hand sanitiser





How Clean are Your Hands?



Very Dirty



Dirty



A Bit Dirty



Clean





Wash your hands with soap and water for 20 seconds



1



Palm to palm

2



Backs of hands

3



Between fingers

4



Backs of fingers

5



Thumbs

6



Tips of fingers

**To help keep time, sing
'Happy Birthday' twice**





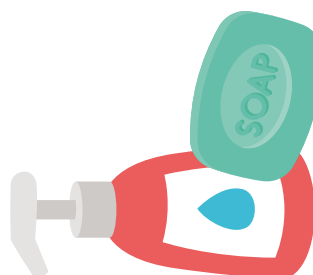
**Back
of fingers**



20 seconds



**Between
fingers**



Soap



**Backs
of hands**



**Tips
of fingers**



**Scrub
your hands**



Thumbs

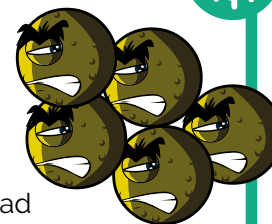




Healthy Hands

Procedure

After the activity, use the 'How Clean are Your Hands?' guide to write your results in the box provided and see how far the microbes have spread



	After washing (or not washing) and shaking hands				
	Student 1	Student 2	Student 3	Student 4	Student 5
No wash (control)					
Wash for 3 seconds					
Wash for 20 seconds					
Wash with soap and water for 20 seconds					

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

The method of hand washing (not control) that removed most microbes from the lead person was:

☐ Wash for 3 seconds ☐ Wash for 20 seconds ☐ Wash with soap and water for 20 seconds

The method of hand washing (not control) that removed fewest microbes from the lead person was:

☐ Wash for 3 seconds ☐ Wash for 20 seconds ☐ Wash with soap and water for 20 seconds

The method of hand washing which spread the most microbes along the line was:

☐ Wash for 3 seconds ☐ Wash for 20 seconds ☐ Wash with soap and water for 20 seconds

The method of hand washing which spread the fewest microbes along the line was?

☐ Wash for 3 seconds ☐ Wash for 20 seconds ☐ Wash with soap and water for 20 seconds

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?



Fascinating Fact

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





Student 1

Student 2

Student 3

Student 4

Student 5

Five handprint outlines for students 1 through 5, arranged in a row. Each handprint is a simple line drawing of a right hand, palm facing up, with a small curved line on the back of the hand. The labels 'Student 1' through 'Student 5' are placed to the right of each respective handprint.





Complete the sentences below using the key words

Our hands are naturally covered with _____ that live on our bodies and pick up millions more from our environment everyday.

Microbes can _____ easily from child to child when we touch each other.

Although some microbes can be useful, others can be harmful and cause _____.

_____ is the most effective way of reducing and preventing the spread of infection.

Washing our hands with _____ and water at key moments removes any harmful microbes we pick up on our hands from our surroundings.

We should wash our hands for _____, which is the length of the happy birthday song twice.

Washing hands in water alone will only remove _____ and grime.

If soap is unavailable, we should use _____ as long as there is no visible dirt/other substance on hands.

Key words:

Hand sanitiser, Microbes, Dirt, Infection, Soap, Hand washing, Spread, 20 seconds





Quiz: Hand Hygiene

Please tick as many answers as appropriate

Name:

How can you spread microbes to others? (2 points)

- ☐ By touching them
- ☐ By looking at them
- ☐ By speaking to them on the phone
- ☐ By sneezing

When should we wash our hands? (3 points)

- ☐ After stroking a pet
- ☐ After sneezing or coughing
- ☐ After watching TV
- ☐ After using the bathroom or changing a soiled nappy

Why should we use soap to wash our hands? (2 points)

- ☐ It helps remove invisible microbes too small to be seen by our eyes
- ☐ It breaks up the oil on our hands which trap microbes
- ☐ It keeps our hands moist
- ☐ It doesn't matter if we use soap or not

How can you stop harmful microbes from spreading? (2 points)

- ☐ Do nothing
- ☐ Wash hands in water
- ☐ Use hand sanitiser if soap and water are not available
- ☐ Wash your hands with running water and soap

Which is NOT one of the 6 steps of hand washing? (1 point)

- ☐ Palm to palm
- ☐ The thumbs
- ☐ Arms
- ☐ In between fingers

After we sneeze into our tissue, we should: (2 points)

- ☐ Wash our hands immediately
- ☐ Dry our hands on our clothes
- ☐ Take antibiotics
- ☐ Put the tissue straight into the bin

Who might be at risk as a result of you not washing your hands properly? (1 point)

- ☐ You
- ☐ Your family
- ☐ Your friends
- ☐ All of the above

How long should we wash our hands for? (1 point)

- ☐ 10 seconds
- ☐ 20 seconds (length of Happy birthday song twice)
- ☐ 1 minute
- ☐ 5 minutes





Spread of Infection: Respiratory Hygiene

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

Curriculum Links

Science

Working scientifically; Living things and their habitats; Animals, including humans

PSHE/RSHE

Health and prevention

English

Reading and comprehension, Spoken language

Mathematics

Comparing measurements

Key Words

Bacteria, Hygiene, Infection, Transmission, Sneeze, Cough, Hand washing

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e-bug.eu/eng/KS2/lesson/Respiratory-Hygiene



Learning Outcomes

All students will:

- Understand that infection can spread through coughs and sneezes.
- Understand that covering your mouth and nose with a tissue or your sleeve (not your hands) when you cough, or sneeze helps prevent the spread of infection.
- Understand that coughing and sneezing in your hand can still spread infection.

Resources Required

Main activity: Super Sneeze

Per Student

- ☐ A copy of SW1

Per Group

- ☐ Long roll of paper such as wallpaper
- ☐ Measuring tape or 2m ruler
- ☐ Pump action spray bottle/s
- ☐ Food colouring (a few different colours)
- ☐ Disposable plastic/vinyl gloves
- ☐ Kitchen roll
- ☐ Cardboard
- ☐ Jelly (optional)

**Optional Activity:
Super Slimy Snot Activity**

Per group

- ☐ Copy of SH1

Extension Activity 1: Poster

Per group

- ☐ A4 paper
- ☐ Colouring pens/pencils

**Extension Activity 2:
Respiratory Hygiene Quiz**

Per group

- ☐ Copy of SW2

Extension Activity 3: Fill in the Blank

Per student

- ☐ Copy of SW3

Advance Preparation

1. To expand on this experiment from KS1 take the runway to the playground. Create a runway by placing 3-4 desks in a row and covering them with white paper (lining wallpaper is an inexpensive alternative).
2. Fill one spray bottle per group with water and food colouring. A colour for each group makes the activity more exciting.
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.
5. Optional: add snot to the experiment, make your own snot following SH1, or alternatively use jelly.

Health and Safety

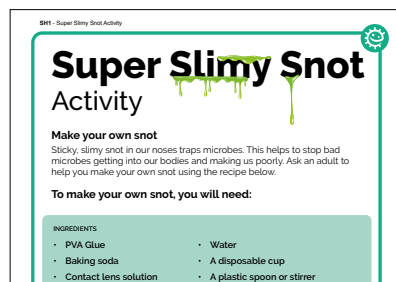
Students may require aprons and gloves.

Ensure that the food colouring is diluted to avoid staining.

Ensure that all spray bottles have been thoroughly cleaned and rinsed prior to use.

Students may need to wear safety goggles.

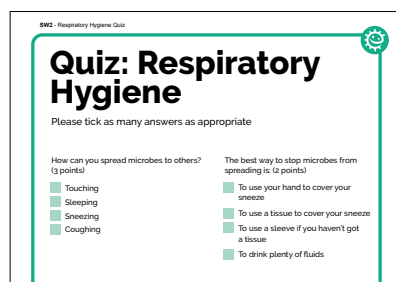
Supporting Materials



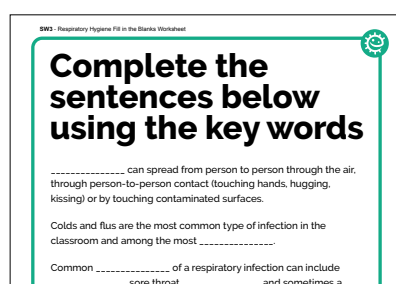
SH1 Super Slimy Snot



SW1 Super Sneeze Recording Sheet



SW2 Respiratory Hygiene Quiz



SW3 Respiratory Hygiene Fill in the Blanks Worksheet

Modifications

If there is an outbreak of infection and mask wearing is recommended, you can include a step to show how a mask can block the microbes from a sneeze/ cough.

Always include a tissue as a step and re-enforce the message to catch it, bin it, kill it and wash hands afterwards.

Lesson plan



Introduction

1. Begin the lesson by explaining to the students that they are going to learn how germs (microbes) can be passed from person to person through coughing and sneezing. Ask students what they think people mean when they say 'You gave me the cold' or 'I caught the flu from you'.
2. Remind the students that, although infections can spread from person to person, there are usually a few different ways that we could have been exposed to the germs that caused it. It is usually impossible to know who we caught the infection from and it is important that we all take responsibility for preventing the spread of these germs by properly covering coughs/sneezes, good hand washing and not touching our eyes and face with unwashed hands.
3. Explain to students that the germs that cause some diseases are so small that they can travel through the air in water droplets when people cough or sneeze. If you are doing activity two where you make snot, it is useful to refer to that here.
4. Explain that the diseases spread in this way range from the common cold to rarer or more serious infections such as tuberculosis (TB).
5. 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, or to sneeze into the crook of their elbow if they do not have a tissue. The spread of infection can be reduced through good respiratory hygiene.

Discussion

Discuss with students the outcome of their results. Ask them to look at the hand or glove and notice that the spray 'microbes' are still on it.

Discuss with students why you may want to sneeze into the crook of your elbow or sleeve if no tissue is available.

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. Recent guidance recommends we sneeze or cough into the crook of our elbow because we are less likely to transmit harmful microbes to other people by doing this.

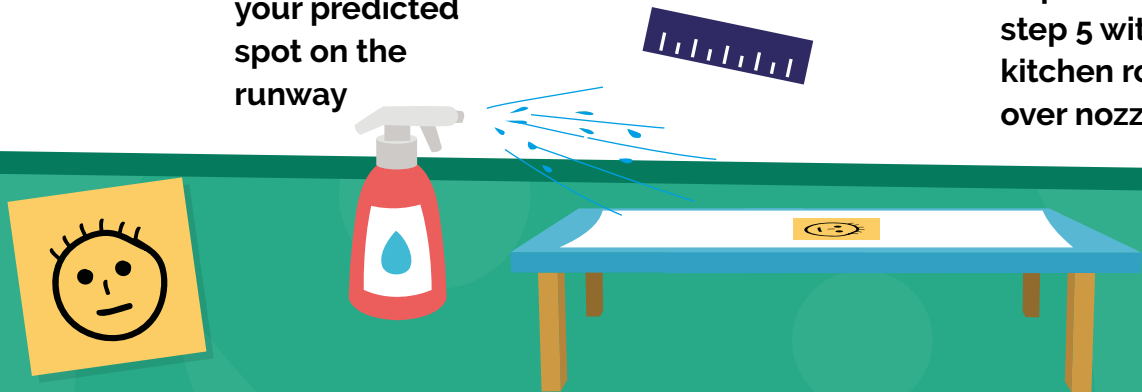
Show them that when they place the hand on the paper, sprayed side down, the microbes transfer to the paper. Explain that sneezing in your hand can spread the microbes to things that we touch, so it is better to sneeze into the tissue and then throw it away and wash your hands or use hand sanitiser as soon as possible, or into your sleeve/crook of your elbow if you have no tissue.

If using the options to wear a mask, you can discuss with the students why we may be asked to wear a mask when there is an outbreak of respiratory infection.



Main Activity: Super Sneeze

- 1 Predict how far you think the sneeze will travel
- 2 Draw a picture of yourself on a sticky note and place at your predicted spot on the runway
- 3 Spray the bottle from end of runway
- 4 Measure the distance
- 5 Spray the bottle with hand/glove over nozzle
- 6 Repeat step 5 with kitchen roll over nozzle



Main Activity: Super Sneeze

1. Divide the class into groups of 4-5 students.
2. Each group should be provided with the runway, a spray bottle, a measuring tape or ruler, a giant hand or glove and a giant tissue. Provide each student with an SW1 recording sheet. Ensure they have read and understood the instructions before starting the activity.
3. To demonstrate the distance a cough sneeze and thus the microbes in the cough/sneeze can travel, students should take turns holding the bottle at the end of the runway and simulate a cough/sneeze by squeezing the trigger once over the paper. Before 'coughing/sneezing' (squeezing the trigger) students should predict how far and wide the sneeze will go and fill this in on their results sheet (SW1). They can also write their name on a sticky note before each 'sneeze' and place it on the runway to see whose prediction was the closest. After 'sneezing' students should measure and record how far and how wide each student's sneeze spreads and fill this on their results sheet..
4. The next step is to observe what happens when we put our hand over our mouth when we sneeze; the microbes stay on our hands and can spread to anything we touch. One student in each group should be the 'sneezer' and the second student should hold the giant or gloved hand about 2-5cm away from the spray bottle. Students should fill both predicted and actual outcomes on their results sheet.
5. Finally, we want to observe what happens when we cover our mouth with a tissue during sneezing. Ask a different student in each group to be the 'sneezer' and ask another student to hold the tissue directly in front of the spray nozzle. Students in the group should fill in both predicted and actual outcomes on SW1 and draw a graph of the results.

Optional Activity: Super Slimy Snot

The super sneeze activity demonstrates when you sneeze small microbes can travel far. To expand on this experiment, you may wish to show that large droplets and snot are also expelled during a sneeze.

Did you know that the human body produces 1-1.5 litres of snot a day? This can increase when we have a respiratory infection. To help students learn about snot and foster discussion about the microbes it contains, you can make your own using the recipe – Super Slimy Snot (SH1). Alternatively, you can use jelly.

Students can feel the texture and play with the snot. Explain to students that the gooey snot is heavier than the smaller microbes and won't travel as far down the runway.

Extension Activities

Hand Hygiene Poster Design

Ask students to design a poster showcasing good respiratory hygiene messages such as 'catch it, bin it, kill it' or 'cover your sneezes, dispose of tissues and regularly wash your hands'. This activity can be combined with the end of lesson learning consolidation.

Respiratory Hygiene Quiz

SW2 is a fun consolidation quiz. Allocate students to groups of 3 or 4 and provide one quiz sheet per team. The team with the most points wins. Answers are available on the e-Bug website.

Fill in the Blanks

Provide students with SW3 and ask them to fill in the blanks using the correct words provided. Students can complete this activity individually in the classroom or as homework.

Learning Consolidation

At the end of the lesson, ask the class to create some simple rules or messages to reduce the spread of coughs, colds and flu in their school, for example:

- ☐ Coughs and sneezes spread diseases.
- ☐ Catch it, bin it, kill it.
- ☐ Cover my coughs and sneezes with a tissue or cough/sneeze into the crook of my elbow (not my hand).
- ☐ Wash my hands after a cough or a sneeze or use hand sanitiser.





Super Slimy Snot Activity

Make your own snot

Sticky, slimy snot in our noses traps microbes. This helps to stop bad microbes getting into our bodies and making us poorly. Ask an adult to help you make your own snot using the recipe below.

To make your own snot, you will need:

INGREDIENTS

- PVA Glue
- Baking soda
- Contact lens solution
- Green food colouring
(you will find this in the baking aisle of the supermarket)
- Water
- A disposable cup
- A plastic spoon or stirrer
- Rubber gloves
- Eco friendly glitter (optional)

Method

1. Put the gloves on. To a cup, add a few pinches of baking soda for every 30g of glue (around 1tsp per bottle of glue). Stir to mix the baking soda and glue.
2. Once the baking soda is fully incorporated, add a few drops of green food colouring and glitter (optional). Stir to Mix.
3. Then add water to change the consistency of the slime as preferred.
4. Finally, add the contact lens solution and stir until the glue isn't sticky anymore.

You can play with the snot, but do not eat it

Wash your hands when you have finished playing with the snot. It will last a few days if you keep it wrapped up in cling film.





Super Sneezes

- 1 What do you think will happen when you put the hand over the mouth to sneeze?
Make a prediction.

- 2 What do you think will happen when you put the tissue over the mouth to sneeze?
Make a prediction.

My Observations

How far did your
sneeze travel?

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

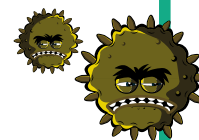
- 3 What actually happened when the hand was over the mouth to sneeze?
(Where and how far did the sneeze travel?)

- 4 What actually happened when the tissue was over the mouth to sneeze? (Where
and how far did the sneeze travel?)

My Conclusions

- 1 Why is hand hygiene important after coughing and sneezing?

- 2 What can we do to stop germs spreading from person to person?





Quiz: Respiratory Hygiene

Please tick as many answers as appropriate

How can you spread microbes to others?
(3 points)

- ☐ Touching
- ☐ Sleeping
- ☐ Sneezing
- ☐ Coughing

The best way to stop microbes from spreading is: (2 points)

- ☐ To use your hand to cover your sneeze
- ☐ To use a tissue to cover your sneeze
- ☐ To use a sleeve if you haven't got a tissue
- ☐ To drink plenty of fluids

After we sneeze into our hands, we should: (2 points)

- ☐ Wash our hands
- ☐ Dry our hands on our clothes
- ☐ Take antibiotics
- ☐ None of the above is necessary

What should you do with a tissue after sneezing into it? (1 point)

- ☐ Put it in your pocket for next time
- ☐ Put it straight in the bin
- ☐ Put it up your sleeve for next time
- ☐ Any of the above

If you do not have a tissue available, the best option from the following is to sneeze:
(1 point)

- ☐ Into your hands
- ☐ Into your sleeve
- ☐ Into an empty space
- ☐ Onto your desk

What might happen if we don't wash our hands after sneezing into them?
(1 point)

- ☐ Nothing
- ☐ Transfer harmful microbes to other people
- ☐ Help protect our microbes





Complete the sentences below using the key words

_____ can spread from person to person through the air, through person-to-person contact (touching hands, hugging, kissing) or by touching contaminated surfaces.

Colds and flus are the most common type of infection in the classroom and among the most _____.

Common _____ of a respiratory infection can include _____, sore throat, _____, and sometimes a runny or blocked nose.

We can prevent microbes being transmitted from person to person by covering our _____ and _____ with a tissue and throwing away the tissue immediately.

We should always wash our hands with soap and water, or _____ if soap and water are not available, immediately after throwing away the tissue.

Although there are many _____ microbes that can make us ill, we can prevent some infections by getting _____.

Key words:

headaches, hand sanitiser, fever, vaccinations, symptoms, microbes, sneezes, coughs, harmful, contagious





Spread of infection: Food Hygiene

Students will go through an interactive quiz which follows the preparation of a meal. Along the way, students will have to make decisions about what to do next and answer questions.

Curriculum Links

Science

Working scientifically, Living things and their habitats; Animals, including humans

PSHE/RSHE

Health and prevention

English

Reading and comprehension;
Spoken Language

Design and Technology

Cooking and nutrition

Key Words

Microbes, Foodborne illness, Bacteria,
Use by, Best before, Refrigeration

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[e-bug.eu/eng/KS2/lesson/
Food-Hygiene](http://e-bug.eu/eng/KS2/lesson/Food-Hygiene)

Learning Outcomes

All students will:

- Understand that microbes can be found on our food and can transfer to humans.
- Understand that cooking food properly can kill harmful microbes.
- Understand that bacterium multiply very quickly.

Most students will:

- Understand that refrigeration only stops microbes growing, it doesn't kill them.
- Understand the difference between "use by" and "best before".

Resources Required

Starter Activity: Class Discussion

Per class

- ☐ Copy of SH1
- ☐ Copy of SH2

Main Activity: Kitchen Check

Per class

- ☐ Copy of PP1 (available from e-bug.eu website)

Extension Activity 1:

Fridge Raiders

Per group

- ☐ Copy of SH3
- ☐ Copy of SH4
- ☐ Copy of TS1

Extension Activity 2:

Food Hygiene Quiz

Per student

- ☐ Copy of SW1

Extension Activity 3:

Spot the Mistake

Per group

- ☐ Copy of SW2

Extension Activity 4: Label Sort

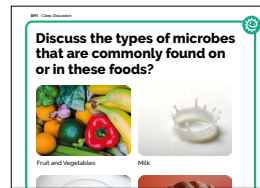
Per student

- ☐ Copy of SW3

Advance Preparation

For the Extension Activity Fridge Raiders, laminate a copy of SH3 and the images on SH4. Alternatively MS PowerPoint Slides of the images are available on the e-Bug website e-bug.eu.

Supporting Materials



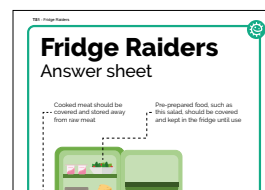
SH1 & SH2 Class Discussion



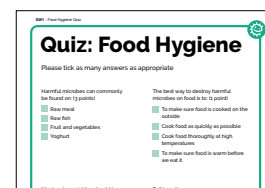
SH3 Fridge Raiders



SH4 Fridge Raiders



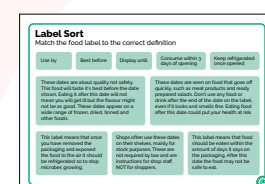
TS1 Fridge Raiders



SW1 Food Hygiene Quiz



SW2 Spot the Mistakes



SW3 Label Sort

Lesson Plan



Introduction

1. Explain to the students that some microbes like to grow in nice warm damp places, such as inside our bodies, and when they find somewhere they like, they grow and multiply. But they usually don't like places that are very warm or cold. Explain to the class that for this lesson they will be learning 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 it. 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 bacterium. Show the class pictures of various food types (SH1) and ask them which they think could contain the useful/harmless bacteria and which contain the harmful bacterium. Answers for the discussion are provided on SH2.

Main Activity: Kitchen Check

1 Open the Kitchen Check MS PowerPoint quiz

2 Make decisions about preparing a meal

3 Learn about good food hygiene along the way



Main Activity: Kitchen Check

1. Set up the Kitchen Check MS PowerPoint quiz (available on the e-Bug website e-bug.eu) on a computer, tablet or projector.
2. Students take part in an interactive quiz which follows the preparation of a meal. Students will be presented with questions to answer and explanations will be displayed.
3. At the end of the quiz, students will understand where food hygiene risks lie and will be able to apply them to their own food preparation practices.

Extension Activities

Fridge Raiders

Using the laminated copies of SH3 and SH4, lay out the images of the large fridge and foods kept in the fridge on a table or display the student handouts on a whiteboard.

Ask students to place the foods in the fridge on the correct shelf according to best food hygiene practices. Ask the students which foods should also be covered up to prevent cross contamination. Teacher answers can be found in TS1.

Students learn how to store food safely, and that refrigeration only slows the growth of microbes, it doesn't kill them.

Food Hygiene Quiz

Provide SW1 to groups of 3 or 4 students.

The team with the most points wins.

Alternatively the quiz can be completed at the beginning of the lesson to measure understanding. Answers are available on the e-Bug website.

Spot the Mistake

Provide SW2 to groups of 2 or 3 and ask students to spot the best practice kitchen mistakes and discuss them with the class. Answers are available on the e-Bug website.

Label Sort

Allocate SW3 to groups of 3 or 4. Ask students to match food labels to their correct definition to help students learn how to consume food safely.



Learning Consolidation

At the end of the lesson, ask the class if they can name ways to reduce the spread of microbes when handling food.

For example:

- ☐ Wash my hands before and after handling food.
- ☐ Clean kitchen surfaces and utensils before and after preparing food.
- ☐ Wash fruit and vegetables before eating them.
- ☐ Don't wash raw meat to avoid harmful microbes splashing onto other foods and surfaces.
- ☐ Don't eat food that is past its used by date.





Discuss the types of microbes that are commonly found on or in these foods?



Fruit and Vegetables



Milk



Yoghurt



Bread



Chicken



Sausages





Answers



Fruit and Vegetables: 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 cooking and/or eating them.



Milk: Fresh milk contains *Lactobacillus* Bacterium which help us digest food. There can also be harmful microbes that are removed when the milk is heated up (pasteurized) before it is sent to the shops.



Yoghurt: Yoghurt usually contains *Lactobacillus* Bacterium which help us digest food.



Bread: The yeast *Saccharomyces cerevisiae* helps bread to rise.



Raw Chicken: Raw chicken may contain *Salmonella*, *E. coli* or *Campylobacter* Bacterium, all of which can cause food poisoning in humans.



Raw Sausages: Raw meat may contain *Salmonella*, *E. coli* Bacterium which can cause food poisoning in humans.





Fridge Raiders

Answer sheet

Cooked meat should be covered and stored away from raw meat

Pre-prepared food, such as this salad, should be covered and kept in the fridge until use



Some jars of food, for example jam, need to be stored in the fridge once opened

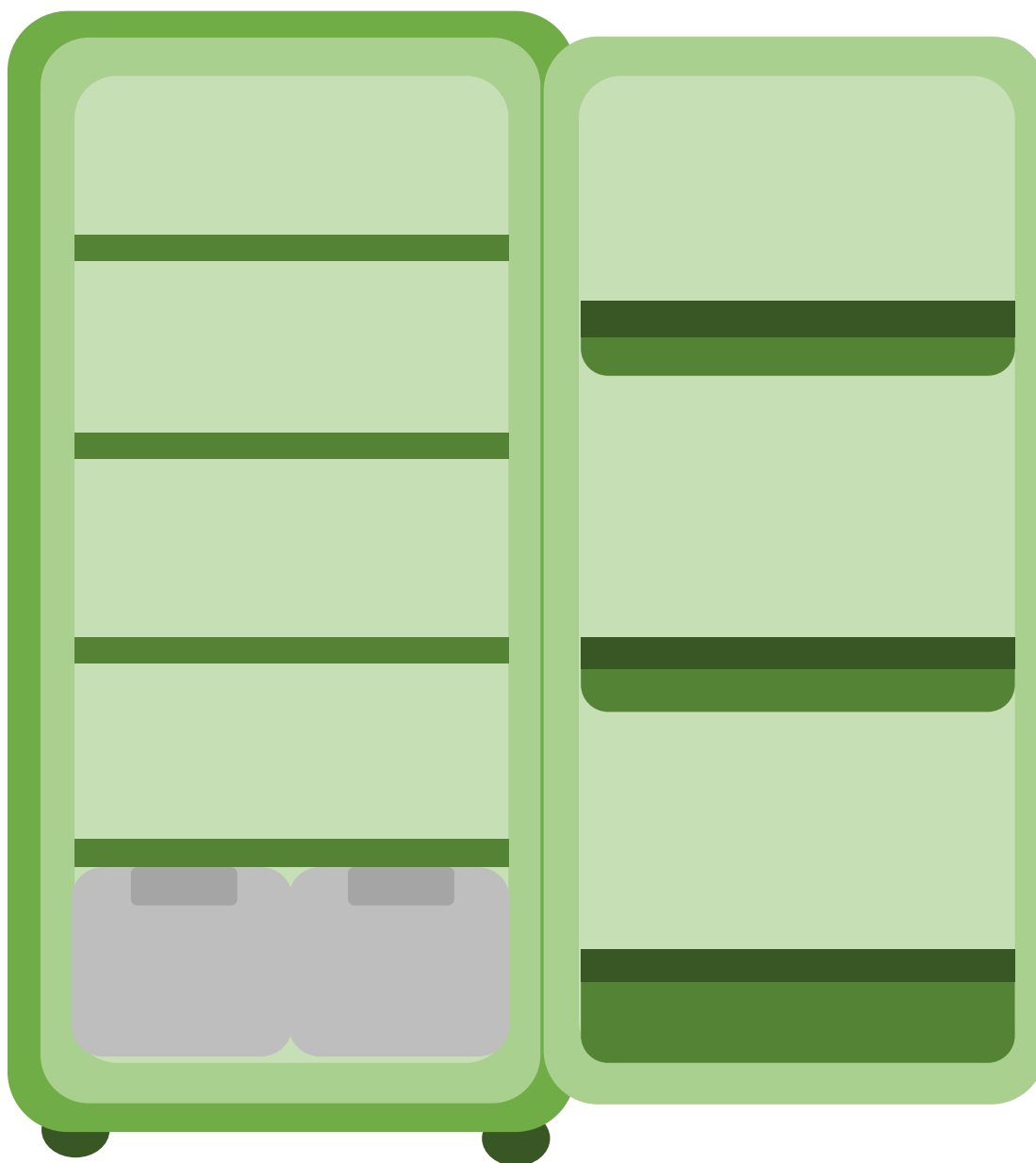
Raw meat and fish should be covered and kept on the bottom shelf in the fridge

Store fruit and vegetables and salad in the draw at the bottom of the fridge



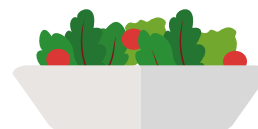
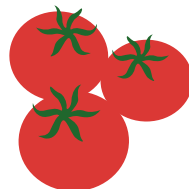
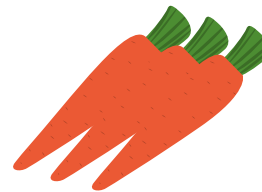
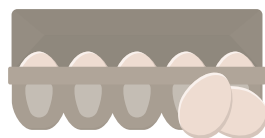
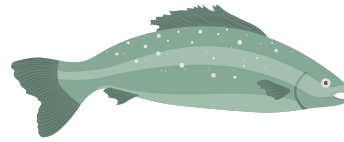
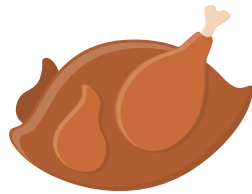


Fridge Raiders





Fridge Raiders





Quiz: Food Hygiene

Please tick as many answers as appropriate

Harmful microbes can commonly be found on: (3 points)

- ☐ Raw meat
- ☐ Raw fish
- ☐ Fruit and vegetables
- ☐ Yoghurt

The best way to destroy harmful microbes on food is to: (1 point)

- ☐ To make sure food is cooked on the outside
- ☐ Cook food as quickly as possible
- ☐ Cook food thoroughly at high temperatures
- ☐ To make sure food is warm before we eat it

Meat and vegetables should be: (1 point)

- ☐ Sorted on the same shelf in the fridge
- ☐ Cut on different chopping boards
- ☐ Cut with the same knife
- ☐ Stored in a warm cupboard

Refrigeration: (2 points)

- ☐ Kills all microbes
- ☐ Speeds up microbe growth
- ☐ Only stops microbes growing, it doesn't kill them
- ☐ Should be set to 4°C or below

Which food may contain useful microbes? (3 points)

- ☐ Cheese
- ☐ Yoghurt
- ☐ Bread
- ☐ Raw chicken

How can we prevent food poisoning? (2 points)

- ☐ Store raw meat/chicken in the fridge
- ☐ Cook meat/chicken thoroughly before we eat it
- ☐ By washing raw chicken
- ☐ Eating yoghurt





Quiz: Food Hygiene

Continued.....

Match the terms with their definitions:
(3 points)

Best before

The deterioration of colour, texture and flavour of food

Use by

The food is safe to eat after this date, but may no longer be at its best quality

Food spoilage

Food is safe to eat up until this date, but should not be eaten after it

Which of the following is not one of the four key ways you can prevent food poisoning? (1 point)

- ☐ Cleaning during food preparation
- ☐ Cooking food thoroughly
- ☐ Using the same chopping board and utensils during food preparation
- ☐ Storing food correctly in refrigerators at $\leq 4^{\circ}\text{C}$

What infections can you get from poor hand washing? (1 point)

- ☐ Salmonella
- ☐ Cold and flu
- ☐ Diarrhoea
- ☐ All of the above





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





Label Sort

Match the food label to the correct definition

Use by

Best before

Display until

Consume within 3 days of opening

Keep refrigerated once opened

These dates are about quality not safety. This food will taste it's best before the date shown. Eating it after this date will not mean you will get ill but the flavour might not be as good. These dates appear on a wide range of frozen, dried, tinned and other foods.

These dates are seen on food that goes off quickly, such as meat products and ready prepared salads. Don't use any food or drink after the end of the date on the label, even if it looks and smells fine. Eating food after this date could put your health at risk.

This label means that once you have removed the packaging and exposed the food to the air it should be refrigerated so to stop microbes growing.

Shops often use these dates on their shelves, mainly for stock purposes. These are not required by law and are instructions for shop staff, NOT for shoppers.

This label means that food should be eaten within the amount of days it says on the packaging. After this date the food may not be safe to eat.





Spread of Infection: Animal and Farm Hygiene

Students play an interactive memory card game to highlight the similarities between human and animal health.

Curriculum Links

Science

Working scientifically, Living things and their habitats; Animals, including humans

PSHE/RSHE

Health and prevention

English

Reading and comprehension

Key Words

Pet, Microbes, Transmission, Infection
Prevention, Vaccines, Farm, Hygiene

@ Weblink

[e-bug.eu/eng/KS2/lesson/
Animal-Farm-Hygiene](http://e-bug.eu/eng/KS2/lesson/Animal-Farm-Hygiene)

Learning Outcomes

All students will:

- Understand that what you do to help your pet be healthy is the same as what you need to do for yourself.
- Understand that, just like us, animals should only take antibiotics if necessary and it is important to finish the course.
- Understand that harmful microbes can be found on the farm and that these microbes can spread to humans.
- Understand that by washing our hands and following some basic rules we can reduce the chance of picking up an infection on the farm.

Most students will:

- Understand that some microbes can be transmitted from animals to humans and vice versa.

Resources Required

Starter Activity:

Class Discussion

Per class

- ☐ Copy of PP1 (available from the e-bug.eu website)

Main Activity: Memory Game

Per group

- ☐ Copy of SH1 (a-d)
- Extension Activity 1: Animal Quiz**

Per student

- ☐ Copy of SW1

Extension Activity 2: Poster

Per student

- ☐ A4 paper
- ☐ Colouring pens/pencils

Extension Activity 3:

Farm Fun Game

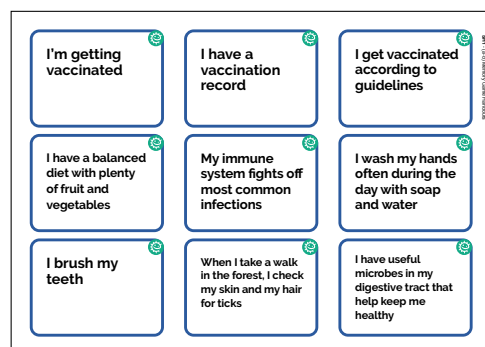
Per student

- ☐ Device to Access the e-Bug website (e-bug.eu)

Advance Preparation

Print and glue on cardboard and/or laminate and cut out the memory game cards illustrating human and animal health issues (SH 1 a-d).

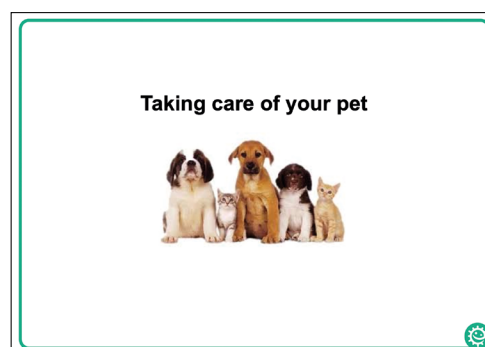
Supporting Materials



SH1 (a-d) Memory Game Handouts



SW1 Animal Hygiene Quiz



PP1 MSPowerPoint –
Taking Care of Your Pet

Lesson Plan



≡ Introduction

1. Begin the lesson by asking how many of your students own a pet, what type of animal it is and how they got it.
2. Discuss students' experience of looking after their pet, ask them where it sleeps, where it is fed. Explain that there are many similarities between human and animal health (you can use the MS PowerPoint presentation: Taking care of your pet, PP1 to explain this to the class).
3. Both people and animals harbour microbes. Useful microbes can help to keep animals in good health, while certain harmful microbes can make them ill, just as they can in people. Animals can also catch specific infections limited to their species, such as viral infections that can be deadly, like feline leukemia in cats and Parvovirus in dogs.
4. Some harmful microbes can spread from animals to humans (e.g. ringworm from cats or dogs) and vice versa, usually through touch. The best way to stop this happening is to wash our hands often.
5. Explain that pets must be properly fed, de-wormed, their teeth and fur should be checked regularly, and they should be washed with suitable products. Pets should also have a dedicated spot of their own and their bedding should be regularly disinfected.
6. Animals also need to be vaccinated to protect them against certain severe infections. Each species has its own vaccination schedule. For instance, rabies has disappeared in some countries thanks to vaccination, just like smallpox in the human population. When our pet gets sick it must be taken to a vet. The vet can do special rapid tests to check for certain diseases. If the vet diagnoses a bacterial infection that needs antibiotics, the prescribed dosage and duration of treatment must be strictly followed. Left over antibiotics from a previous illness should never be used, they should be taken back to the vet or to the pharmacist.
7. Antibiotic use follows the same rules as for people; not using antibiotics properly can lead to bacterial resistance so that the antibiotics don't work. After using antibiotics in both humans or animals, resistant bacteria may grow in the gut and then spread easily from animals to people, or vice versa, and of course between people. For example MRSP (Methicillin-Resistant *Staphylococcus pseudintermedius*) can be spread from humans to animals.
8. Explain to the class that they are going to learn how to prevent infections in their pet.

Main Activity: Memory Game

1 Divide group into two teams; human health (blue) and animal health (green)

2 Shuffle cards and place facing down on a table

3 In turns, pick a card and try to match the pairs

4 The team with the most pairs wins



Main Activity: Memory game

This activity is a memory card game that highlights the similarities between human and animal health. Each card (SH1 a-d) displays a situation which students may encounter when caring for their pet and a parallel situation concerning their own health.

Rules

- Two cards should be matched, one for human health (blue) and one for animal health (green).
- Divide the class into two teams, one for human health (blue), the other for animal health (green).
- Shuffle the cards and lay them face down on a table.
- In turn, a player from each team picks a card of their team's colour, shows it to the class and puts it back where it was, face down.
- All players try to memorise the location of the cards.
- When a player thinks he or she has memorised a pair of cards and it is his or her turn to play, he/she can keep this pair and play again. The team gets a point for each matched pair of cards.
- Warning. If a player makes a mistake, then the team must give back a pair of cards that it had already won.
- One of the animal health cards has no match for human health (I must deworm my pet). The team who gets this card must give back a pair of matched cards.
- The team with the most matched pairs is the winner.

Discussion

What must be done to keep a pet in good health?

Make sure to check your animal's general and dental hygiene, keep its resting spots clean and don't forget to wash your hands with soap and water afterwards, feed and regularly de-worm your pet properly, get your pet vaccinated as soon as possible according to the recommended schedule for the species concerned.

Make sure the students have understood the many similarities between human and pet health by asking the following questions:

What must be done if a pet is sick? It should be shown to a vet. If the vet prescribes antibiotics, make sure to follow the prescription and give the full course even if the animal appears to recover quickly.

Extension activity

Animal and Farm Hygiene Quiz

Provide SW1 to groups of 3 or 4 students. The team with the most points wins. Alternatively the quiz can be completed at the beginning of the lesson to measure understanding. Answers are available on the e-Bug website.

Animal Poster Design

Ask the students to create a poster as a group (drawings, collages...) to help them understand the similarities between human and animal health and to suggest appropriate slogans. Students should include animals they own, or pets they would like, in similar situations i.e. receiving a vaccination.

Farm Fun Interactive Game

Visit e-bug.eu for this fun game that can be combined with a farm visit. Students are asked to spot the mistakes young visitors are making during the visit and explain why each action may lead to harm.

Learning Consolidation

At the end of the lesson, ask the class if they can name different ways they can look after a pet:

For example:

- ☐ Make sure to check pets general and dental hygiene regularly.
- ☐ Keep its resting spots clean and to wash my hands afterwards.
- ☐ Feed and de-worm pets correctly.
- ☐ See a vet to get pets vaccinated.
- ☐ If the vet prescribes antibiotics, make sure to follow the prescription correctly.



**I get vaccinated
according to
guidelines**



**I wash my hands
often during the
day with soap
and water**



**I have useful
microbes in my
digestive tract that
help keep me
healthy**



**I have a
vaccination
record**



**My immune
system fights off
most common
infections**



**When I take a walk
in the forest, I check
my skin and my hair
for ticks**



**I'm getting
vaccinated**



**I have a balanced
diet with plenty
of fruit and
vegetables**



**I brush my
teeth**





If my doctor
prescribes
antibiotics, I finish
the treatment
prescribed to me



I never take
antibiotics
from a previous
treatment



I don't feed
my pet while
I'm cooking
or eating



If I get sick, I only
take antibiotics if
my doctor
prescribes them



I will return
any leftover
antibiotics to
my pharmacy





I have my pet
vaccinated
according to the
vaccine schedule
of its species



I wash my pet
with suitable
shampoos when
it is dirty



My pet has useful
microbes in their
digestive tract that
help keep them
healthy



My pet has a
vaccination
certificate



My pet has immune
defenses that fight
most common
infections



When I take a walk
in the forest with
my pet, I check their
fur for ticks



I will
vaccinate
my pet



My pet has a
balanced diet
adapted to its
species



I check the
dental condition
of my pet





If the vet prescribes
antibiotics to my pet,
I give them all the
prescribed course
of treatment



I deworm my
pet regularly



I never give
antibiotics from a
previous treatment
to my pet



I let my pet eat
its food in their
own bowl



If my pet gets sick,
I only give them
antibiotics if the vet
prescribes them



I will return
any leftover
antibiotics to
my vet





Quiz: Animal and Farm Hygiene

Please tick as many answers as appropriate

When looking after pets, you should:
(3 points)

- ☐ Brush their teeth
- ☐ Get your pet vaccinated by a vet
- ☐ Feed your pet with any food you can find
- ☐ Deworm your pet regularly

Useful microbes can turn animal products into: (3 points)

- ☐ Milk
- ☐ Yoghurt
- ☐ Cream
- ☐ Cheese

We can help prevent the spread of infection between animals and humans by:
(2 points)

- ☐ Washing our hands with soap and water after playing with animals
- ☐ Kissing or putting our face close to the animals face
- ☐ Regularly wash pets with suitable products
- ☐ Having separate resting spots for pets that are regularly cleaned

When visiting a farm people should wash their hands: (3 points)

- ☐ Before eating
- ☐ After petting the animals
- ☐ After touching the crops
- ☐ After talking with the farmer

Where should you eat your food at a farm? (1 point)

- ☐ On the floor away from the animals
- ☐ A designated picnic area/café
- ☐ Next to the animals so you can share food
- ☐ Near the toilets

If prescribed antibiotics for your pet by the vet, you should:
(2 points)

- ☐ Give your pet the full course of treatment
- ☐ Give your pet antibiotics from a previous treatment
- ☐ Leave any remaining antibiotics at home
- ☐ Follow the required dosage of the prescription





Prevention of Infection: Oral Hygiene

Students learn how they can prevent tooth decay. The activities demonstrate the importance of brushing teeth twice a day and how much sugar many common drinks contain.

Curriculum Links

Science

Working scientifically, Animals, including humans

PSHE/RSHE

Health and prevention

English

Reading and comprehension

Key Words

Plaque, Disease, Enamel, Fluoride, Hygiene, Teeth brushing

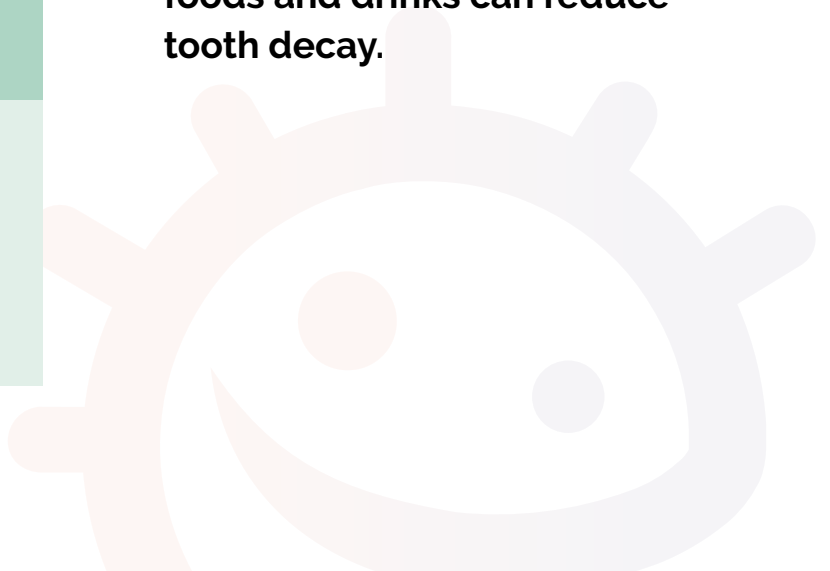
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e-bug.eu/eng/KS2/lesson/Oral-Hygiene

Learning Outcomes

All students will:

- Understand what dental plaque is and how it forms.
- Understand which foods and drinks cause tooth decay.
- Understand the consequences of tooth decay.
- Understand how to brush teeth effectively.
- Understand that limiting sugary foods and drinks can reduce tooth decay.



Resources Required

Main Activity: Attack the Plaque

Per group

- ☐ Water
- ☐ Food colouring (any colour but white)
- ☐ Cornflour
- ☐ Flour (optional)

Per student

- ☐ Toothbrush
- ☐ Yoghurt pot
- ☐ Paint brush

Activity 2: Sugar Drink Activity

Per Group

- ☐ Empty Drinks Bottles
- ☐ Teaspoon
- ☐ Self-Sealing Bag
- ☐ Sugar

Extension Activity: Tooth Brushing Diary

Per student

- ☐ Copy of SW1

Additional Resources:

- ☐ Copy of PP1 (available from the e-bug.eu website)

Advance Preparation

During the lesson or the week before distribute the tooth brushing diary (SW1) alongside the weekly homework. Students should tick if they brushed their teeth that morning or the previous night. Results do not have to be discussed in class.

Set up PP1 (available on the e-Bug website, e-bug.eu).

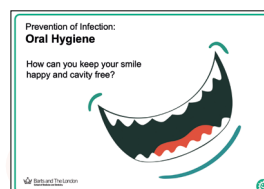
Fascinating Fact

In Medieval times people used to visit the Barber about their teeth troubles. These Barber surgeons extracted teeth as well as cutting hair!

Supporting Materials



SW1 Brushing Diary/Chart



PP1 Oral Hygiene MS PowerPoint Presentation

Lesson Plan



Introduction

Begin the lesson by explaining to the students that tooth decay is a preventable disease using the information contained in the teacher refresher section. Explain students will learn what causes tooth decay and the simple steps they can take to prevent it. Show the students PP1. Use the questions within the presentation to begin a discussion and gather student knowledge.

1. Complete the Main Activity – Keeping your teeth healthy – Attack the Plaque experiment
2. Complete Activity 2 – Healthy Diet – Sugar drink activity

Key message - you can stop tooth decay by:

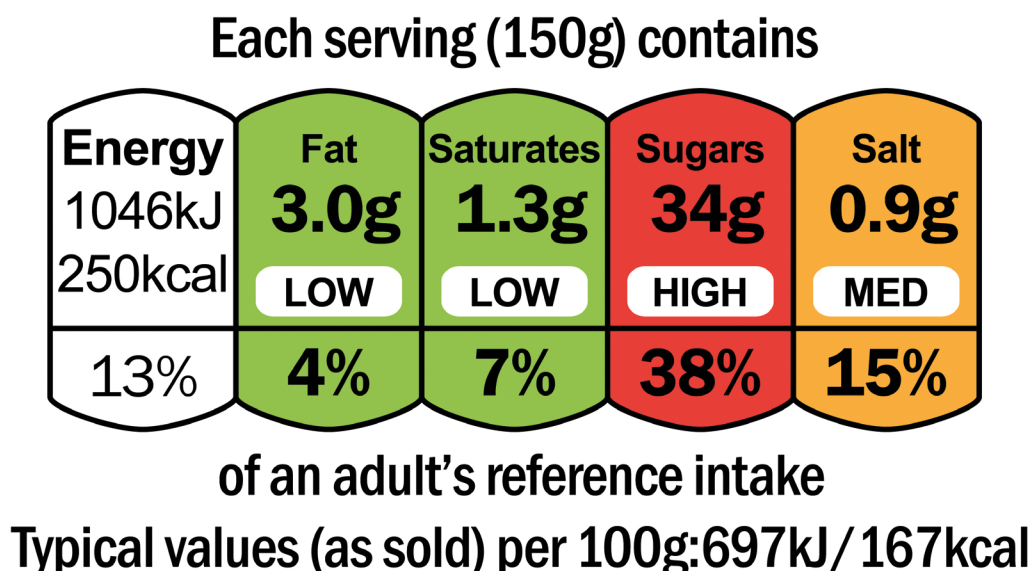
Students should learn that you can prevent tooth decay by eating sugary foods and drinks less often, and in smaller amounts, and by brushing teeth with a fluoride toothpaste last thing before bed and in the morning.

Guidance for Teachers

Below is an example of a nutrition label that can be used to identify the sugar content of foods and drinks.

Red = high sugar content; Amber = medium sugar content; Green = low sugar content

Note: Nutrition labels give the total sugar content, not just added sugar, therefore, some dairy products may be graded amber due to naturally occurring sugars despite having no added sugar.



Discussion

Check for understanding by asking students

How do we get dental decay?

Plaque is a build up of bacteria on our teeth, the bacteria within the plaque breakdown sugars we eat and use them to produce substances including acid. If plaque is not brushed away regularly or if there is too much sugar in the diet, the acid formed dissolves our teeth causing cavities (holes).

Is it OK to drink fizzy drinks that do not contain sugar?

Although these drinks do not contain sugar and are better than sugary versions, the acid can dissolve our tooth enamel over time, making them smaller and sometimes painful. The best drinks are plain water and plain (non-flavoured) milk with no added sugar/sugar-free squash.

What event occurs at around the age of 6 years?

At around age 6, the first permanent molar teeth (at the back of the mouth) erupt. These teeth can be mistaken for milk teeth and often missed when brushing. It is essential to brush these teeth effectively to prevent the onset of dental decay.

Which foods should we limit, and only have occasionally?

Foods and drinks containing sugar should be limited and only had occasionally. Snacking during the day and at bedtime on sugary foods and drinks (especially fizzy drinks!) should be avoided to prevent dental decay. Sugary foods include fizzy drinks, fruit juice and smoothies, full sugar squash, sweets, chocolate, cakes, biscuits, jams, ice-cream, some breakfast cereals, honey and syrups. It's also best to eat dried fruit with a meal, such as with breakfast cereal, instead of as a snack – dried fruit can stick to teeth and cause tooth decay.

How often should we brush our teeth, and how?

It is essential to brush our teeth twice daily, at night and in the morning, as soon as they erupt (around 6-9 months of age), with a smear of toothpaste containing fluoride for under 3 years. Once aged 3 years old, we should use a pea-size amount of toothpaste containing fluoride.

Tooth brushing should be supervised by an adult until 7 years of age. After brushing it is important to spit but not rinse (to leave a protective layer of fluoride on the surface of our teeth). Fluoride helps to keep enamel strong, reducing the chance of acid damaging the teeth.

How can we remember to brush our teeth?

To remember to brush our teeth, it is best to add tooth brushing to a twice daily hygiene routine morning and night.

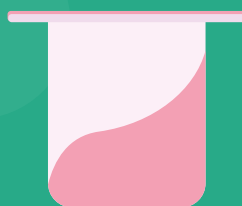
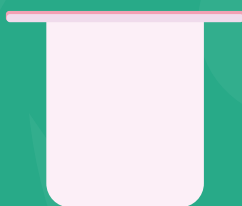
≡ Main Activity: Attack the Plaque

1 Mix water, cornflour and food colouring

2 Paint the outside of a yoghurt pot with the mixture

3 Wait to dry

4 Try to brush the mixture off the yoghurt pots with a toothbrush



≡ Activity 2: Sugar Drink Activity

1 Look at the nutritional information and identify how much sugar is contained in each drink

2 Fill up each bag with the amount of sugar in the drink

3 Make a note of which bag is which drink

4 Ask others if they can identify which drink is which based on the bags

Each serving (150g) contains

Energy	Fat	Saturates	Sugars	Salt
1046kJ 250kcal	3.0g	1.3g	34g	0.9g
	LOW	LOW	HIGH	MED
13%	4%	7%	38%	15%

of an adult's reference intake
Typical values (as sold) per 100g: 697kJ/167kcal



DRINK A

Main Activity: Attack the Plaque

1. Ask students to mix a small amount of water with cornflour and a drop of food colouring.
2. Paint this mixture onto the outside of small white yoghurt pots.
3. Wait for yogurt pots to dry.
4. Now ask the students to try brushing the cornflour mixture (representing plaque) off the yoghurt pots with a toothbrush.
5. Notice that when the cornflour mixture (representing plaque) dries, it is very difficult to brush off. If we don't brush our teeth twice a day, the plaque can harden and become more difficult to remove.

Extension Activity: Attack the Plaque - scientific investigation

This experiment can be expanded to include scientific investigation of the effects of not brushing teeth regularly verses everyday:

Set up three yoghurt pots as below:

1. No cornflour = brush twice a day
2. Wet cornflour = brush once a day
3. Dry cornflour = no brushing

Ask the students to try brushing the cornflour mixture off the pots with a toothbrush. Which is easiest to remove the plaque from?

Students should recognise that brushing teeth everyday makes brushing easier, and that plaque can be hard to remove over time if left on teeth. Hardened plaque is called calculus.

Activity 2: Sugar Drink Activity

This activity is for groups of 2-3 students.

1. Provide each group with a different empty drink bottle from a popular brand (include flavoured and plain water and a range of soft and fizzy drinks), a teaspoon, a bag of sugar and a clear plastic bag (such as a sandwich bag).
2. Before they begin, ask students to look at the nutritional information label and identify how much sugar is contained within each bottle. Help students locate the sugar content on the label, check the amounts and explain the use of the red, amber, green system on the food label. For foods:
 - Red = high amount of sugar
 - Amber = medium amount of sugar
 - Green = low amount of sugar
3. Ask students to fill each bag with the equivalent amount of sugar contained within each drink (1 teaspoon is approximately 4 grams).
4. Once the activity is complete, each group can present their findings (drink name, amount of sugar in grams and number of teaspoons of sugar) to the rest of the class.
5. Students can collate the project and produce a 3D poster board for display within the classroom; containing drink bottles and sugar bags attached to the paper.

Extension Activities

Tooth Brushing Diary

Provide students with tooth brushing diary SW1 during the lesson or 1 week before. Students can keep track of their tooth brushing, encouraging them to brush their teeth as part of their daily routine.

Timing tooth brushing practice

1. In groups encourage pupils to practice their tooth brushing technique on models.
2. Each pupil should demonstrate how long they think it takes to clean the whole mouth effectively.
3. See how long they took compared to the ideal 2 minutes.

Note students may use their electric toothbrushes if they have them.

Tip: Music can help demonstrate to pupils how long they need to brush for. Consider playing a pop song that lasts 2 minutes whilst they practice brushing again.

Learning Consolidation

At the end of the lesson, ask the class the questions below as a fact checker

- ☐ What is the sticky substance made up of bacteria that clump together on our teeth?

Answer: Plaque

- ☐ What sweet substance found in many food and drinks can lead to bacteria and acid attacking our teeth?

Answer: Sugar

- ☐ Why should we limit the number of times we eat foods and drinks with added sugar?

Answer: To prevent plaque build up and tooth decay

- ☐ How many times a day should we brush our teeth with fluoride toothpaste?

Answer: At least twice a day





Brushing Diary



Write the day of the week in the diary and tick each time you have brushed your teeth in the box for that day

Day	Tick for every time you brush your teeth	
Day 1		
Day 2		
Day 3		
Day 4		
Day 5		
Day 6		
Day 7		
Week Total		





Prevention of Infection: Vaccinations

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

Curriculum Links

Science

Working scientifically, Living things and their habitats;

PSHE/RSHE

Health and prevention

English

Reading and comprehension;
Spoken language, Writing

Key Words

Antibody, Antigen, Bacteria, Disease, Immune system, Immunise, Vaccines, Virus, White blood cell (WBC)

Weblink

e-bug.eu/eng/KS2/lesson/Vaccinations

Learning Outcomes

All students will:

- Understand that vaccines help prevent a range of infections, including the flu.

Most students will:

- Understand that there are not vaccines for all infections.



Resources Required

Main Activity: Historic Heroes

Per student



Copy of SH1



Copy of SW1

Extension Activity: Role Play

Per group



Copy of SH2

Extension Activity:

Vaccinations Quiz

Per student



Copy of SW/2

Additional Resources

Per student



Copy of SH3 (available from the e-bug.eu website)



Copy of PP1 (available from the e-bug.eu website)

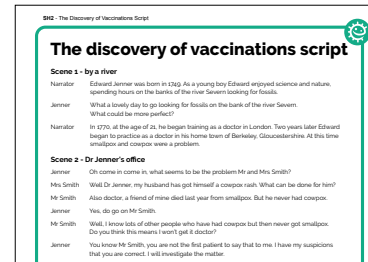
Fascinating Fact

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.

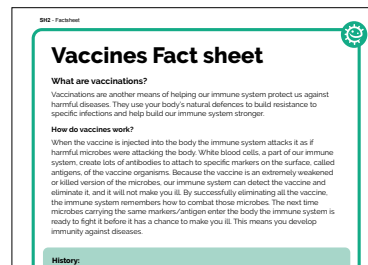
Supporting Materials



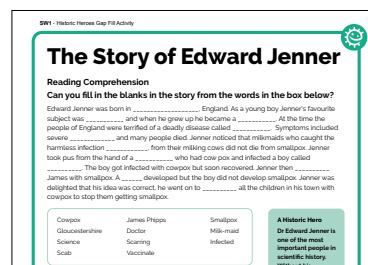
SH1 Historic Heroes Student Handout



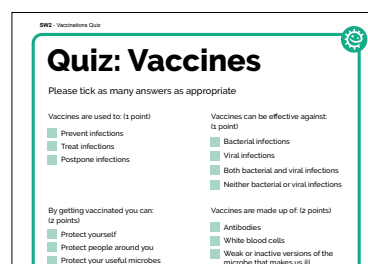
SH2 The Discovery of Vaccinations Script



SH3 Vaccines Factsheet



SW1 Historic Heroes Gap Fill Activity



SW2 Vaccinations Quiz

Lesson Plan



Introduction

1. Begin the lesson by explaining 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 that vaccinations are a harmless small amount of the microbe (e.g. disease markings or outer coat) that teaches our body how to fight the harmful microbe when or if we get attacked by the disease. Discuss class experiences of vaccinations, which vaccinations they remember getting and when they got them. For example, ask students to raise their hands if they have received the flu vaccination at school.
3. Show the class images in PP1 of the disease and bacteria/viruses which they are likely to have been immunised against. Emphasise that in the 1700s these diseases were extremely common.
4. Highlight that without their vaccinations, many of the students in the class would not have survived past 5 years of age. Explain that diseases 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 (e.g common cold/sore throat) or they have to make a new vaccine every year, like the flu vaccine.

Discussion

What are vaccines?
Vaccines protect a person against a particular disease. They are dead or severely weakened versions of the microbe.

Who discovered vaccines?
Edward Jenner discovered vaccines in 1796.

Check for understanding by asking students:

When should vaccines be used?
Vaccines should be administered before an illness occurs; vaccines are a preventative measure.

How does a vaccine work?
A vaccine is an extremely weakened or killed version of the microbes. Our body can find the vaccine, learn how to fight against it and kill it so the vaccine will not make you ill.

Main Activity: Historic Heroes

1 Read the story of Edward Jenner

2 Learn how Jenner created the first vaccine

3 Test your understanding by filling in the blanks and answering the questions



Main Activity: Historic Heroes

1. Provide each student with a copy of SW1.
2. Read the story of Edward Jenner (SH1) to the class, either show the story to the class on the whiteboard or provide each student with a copy of SH1. 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 (SW1).
4. Students should also answer the questions at the bottom of the worksheet.

Students will learn what vaccinations are, how they work, and why they are important.

Extension activity

Discovery of vaccinations role play activity

Provide groups of 3 or 4 students with a copy of SH2. Students can bring the story of Edward Jenner to life by recreating his story into a play to present to the class.

To expand on this activity, ask students to pretend they are Edward Jenner and write a diary entry for the day he made his discovery.

Vaccinations Quiz

Provide groups of 2 or 3 students with SW2 and the team with the most points wins. Answers are available on the e-bug website.

Common Vaccination Questions

Q&A discussion

The following Question and Answer discussion will support student understanding of vaccinations.

Q: What is a vaccination?

A: Vaccinations are another means of helping our immune system protect us against harmful diseases. They use your body's natural defences to build resistance to specific infections and help make our immune system stronger.

Q: Why is vaccination important?

A: Vaccines are a safe and effective way to prevent us from getting ill. Today there are vaccines to protect us from at least 20 diseases including tetanus, influenza, measles, mumps, polio and meningitis. When we get vaccinated, we aren't just protecting ourselves but also the people around us. Vaccines help prevent the spread of infection.

Q: How does a vaccine work?

A: When the vaccine is injected into the body the immune system attacks it as if harmful microbes were attacking the body. White blood cells, a part of our immune system, 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 microbes, our immune system can kill all cells from the vaccine 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. This means you develop

immunity against diseases.

Q: Why should I get vaccinated?

A: Vaccines have saved millions of lives. Without vaccines, we are at serious risk of illness and disability from diseases like polio and meningitis. Vaccinations protect ourselves from illness and others from getting ill too. Not everyone can be vaccinated, sometimes very young babies, very old people and people with serious illness e.g. certain allergies – these people depend on others getting vaccinated to prevent the spread of infection and protect them.



* Modern Vaccine Scientists

As a class discussion or homework activity ask students to consider the following scientists that are making significant discoveries in global vaccine development:

- **Dame Sarah Gilbert**
Co-Creator of the Oxford/AstraZeneca COVID-19 vaccine.
- **Kathrin Jansen**
Vaccine lead at Pfizer, co-developer of the COVID-19 Pfizer-BioNTech vaccine.
- **Hanneke Schuitemaker**
Vaccine lead at Johnson & Johnson's Janssen Vaccines & Prevention.
- **Gagandeep Kang**
Microbiologist and virologist researching viral infections in children (in particular rotaviral vaccines – rotaviruses are a common cause of severe diarrhoea among young children).

Or ask students to find their own examples.

✓ Learning Consolidation

At the end of the lesson, ask the class the questions below as a fact checker

- ☐ What bodily system fights any harmful microbes that may enter our bodies?

Answer: Our immune system

- ☐ Vaccines help prevent a range of infections, for example...?

Answer: i.e. influenza, COVID-19, measles, mumps, rubella, polio, meningitis, whooping cough, TB Or any other example you may have provided

- ☐ True or False: There are vaccines for all infections?

Answer: False

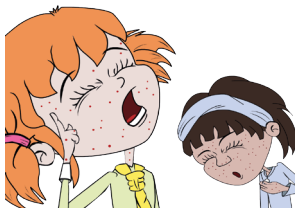




Historic Heroes



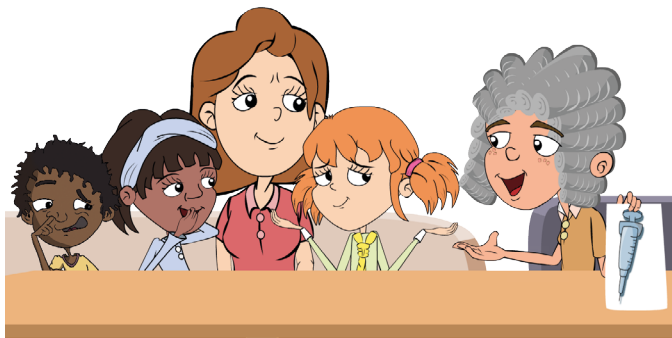
Edward Jenner was born in 1749. As a young boy, Edward enjoyed science and nature, and spent hours on the banks of the River Severn looking for fossils. In 1770, at the age of twenty one, he began training as a doctor in London. Two years later Edward began to practise as a doctor in his home town of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



During this time, people were terrified of a horrible disease called smallpox. People who got this disease got severe scarring from lesions 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 carried 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 that she caught from Blossom the cow. 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's theory was right. Jenner's discovery came to be known as vaccination from the Latin word for a cow: vacca. Jenner went on to vaccinate all the local children with the cowpox to stop them from getting the more dangerous smallpox disease.





The discovery of vaccinations script

Scene 1 - by a river

Narrator 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.

Jenner What a lovely day to go looking for fossils on the bank of the river Severn. What could be more perfect?

Narrator In 1770, at the age of 21, he began training as a doctor in London. Two years later Edward began to practice as a doctor in his home town of Berkeley, Gloucestershire. At this time smallpox and cowpox were a problem.

Scene 2 - Dr Jenner's office

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's theory was right 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 from getting smallpox. Even today his work is still recognized and Gloucestershire Royal Hospital has a unit named after him.





The Story of Edward Jenner

Reading Comprehension

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

Edward Jenner was born in _____, England. As a young boy Jenner's favourite 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.

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

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.

Did you know?

By the age of 9, each child may have had at least 12 injections to prevent 13 different dangerous infections.

Fascinating Fact

Vaccination comes from the Latin word for a cow – vacca

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?





Quiz: Vaccines

Please tick as many answers as appropriate

Vaccines are used to: (1 point)

- ☐ Prevent infections
- ☐ Treat infections
- ☐ Postpone infections

Vaccines can be effective against: (1 point)

- ☐ Bacterial infections
- ☐ Viral infections
- ☐ Both bacterial and viral infections
- ☐ Neither bacterial or viral infections

By getting vaccinated you can: (2 points)

- ☐ Protect yourself
- ☐ Protect people around you
- ☐ Protect your useful microbes

Vaccines are made up of: (2 points)

- ☐ Antibodies
- ☐ White blood cells
- ☐ Weak or inactive versions of the microbe that makes us ill
- ☐ Strong microbes that make us ill

How do vaccines work? (1 point)

- ☐ They block the entry of microbes in the body
- ☐ They kill microbes in your body
- ☐ The immune system attacks the vaccine and remembers for next time

Herd immunity is: (1 point)

- ☐ When animals such as cattle have been vaccinated
- ☐ A type of immunity naturally present in the body
- ☐ When enough of the population is vaccinated to prevent the spread of a certain infection
- ☐ None of the above

Which diseases cannot be prevented by vaccination? (2 points)

- ☐ Common cold
- ☐ Measles
- ☐ Sore throat
- ☐ Polio

Which diseases are eradicated or rare thanks to vaccinations? (3 points)

- ☐ Smallpox
- ☐ Cough
- ☐ Polio
- ☐ Tetanus





Treatment of infection: Antibiotics

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

Curriculum Links

Science

Working scientifically, Animals, including humans (Upper KS2 only)

PSHE/RSHE

Health and prevention

English

Reading and comprehension

Key Words

Antibiotic, Disease, Immune system, Infection, Medicine, Natural defences, Vaccine

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Learning Outcomes

All students will:

- Understand that most common infections get better on their own through time, bed rest, hydration and healthy living.
- Understand that if antibiotics are taken, it is important to finish the course.
- Understand that antibiotics treat bacterial infections only.
- Understand that they should not share antibiotics or other medicines that are prescribed by a doctor or healthcare professional.

Resources Required

Main Activity:
Comic Strip Scenarios
Per group

- ☐ Copy of SH1
- ☐ Copy of SH2
- ☐ Copy of TS1

Extension Activity 1:
Antibiotics Flash Cards
Per group

- ☐ Copy of SH3

Extension Activity 2:
Word Mix Up
Per student

- ☐ Copy of SW1

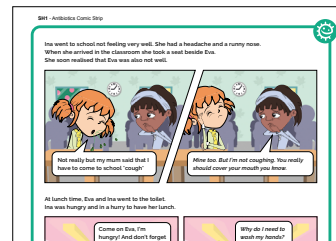
Fascinating Fact

In 1901, most people didn't live past 47 years old. Now most people live to the age of 77 years or longer thanks to modern medicines like antibiotics.

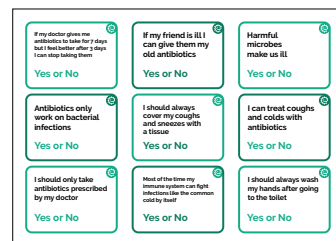
Supporting Materials



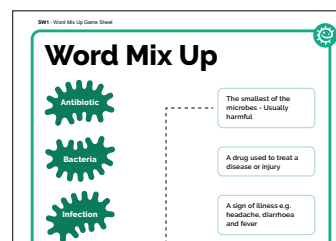
TS1 Teacher Discussion Points



SH1-2 Antibiotics Comic Strip



SH3 Antibiotics Flashcards



SW1 Word Mix Up Game Sheet

Lesson Plan



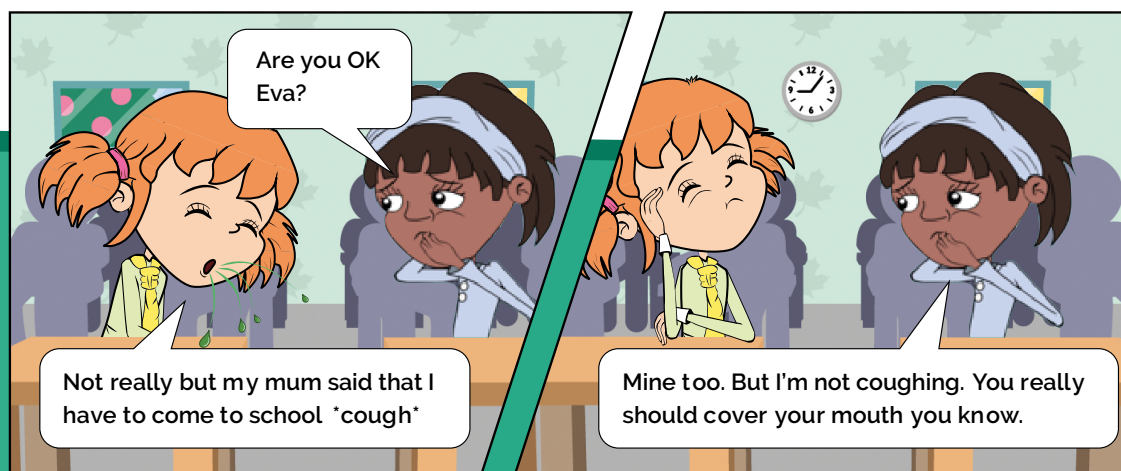
Introduction

1. Begin the lesson by explaining to the students that they are going to learn about some common infections and when antibiotics should and should not be used. Remind students that harmful microbes can cause an infection and make us ill. Ask students about their own experiences of being ill, what was the illness, how did they feel and what did they do? Did they think it was caused by a microbe/ infection? If so, why did they think that? Did they stay at home or did they go to the doctor or visit the chemist? Did they get any medicine?
2. Tell students that before we get medicine for common infections, 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 medicines that are used to treat only bacterial infections. Antibiotics make us better by stopping or killing the harmful bacteria that make us ill. Explain to students that different antibiotics affect 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, nurse or chemist. Explain that antibiotics will not work on infections caused by a virus, for example antibiotics cannot stop or kill COVID-19 or the common cold.
5. Explain that if we do get antibiotics from the doctor, nurse or chemist 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 to the bacteria.
6. Students should know that many of the other medicines e.g. pain killers or cough mixtures are used to relieve the symptoms of infection such as headaches, fever, congestion, etc.

Main Activity: Comic Strip Scenarios

1 Read through the comic strips

2 Make decisions about antibiotic use for the characters



Main Activity: Comic Strip Scenarios and discussion

This activity can be carried out in small groups or as a classroom discussion. The task is presented like a cartoon story.

1. Each section of the cartoon has a situation with a decision that needs to be made. The words spoken by the decision maker are in *italics* to highlight them.
2. Show each box to the students (either all together SH1 and SH2, or as individual boxes on the white board) and discuss whether the decision maker has made the right or wrong choice.
3. Discussion points can be found in TS1. Students will learn how and when to use antibiotics appropriately.

Extension Activities

Antibiotic flashcards

This activity can be carried out in small groups of 3 or 4 or as part of a class discussion. Provide students with SH3 and ask them to answer either 'yes' or 'no' to the statements. Answers are available on the e-bug website.

Word mix up game sheet

This fun activity can be carried out either individually or in groups of 2 or 4 students. Provide students with SW1. Students should match the word on the left-hand column with the definition on the right-hand column. Answers are available on the e-bug website.

Learning Consolidation

At the end of the lesson, ask the class if they can name different ways to correctly use antibiotics.

For example:

- ☐ Only use antibiotics prescribed to me by my doctor
- ☐ Always finish the course once started
- ☐ Never take somebody else's antibiotics
- ☐ Sign up to become an antibiotic guardian
- ☐ Or write your own

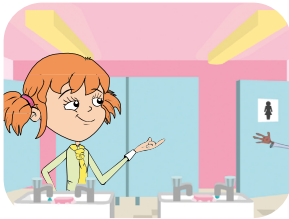




Discussion Points



Eva 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 harmful 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.



Eva 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 Brooke should have washed Luca'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 plaster, fresh air will help the scabbing process.



Dr Cooper 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.

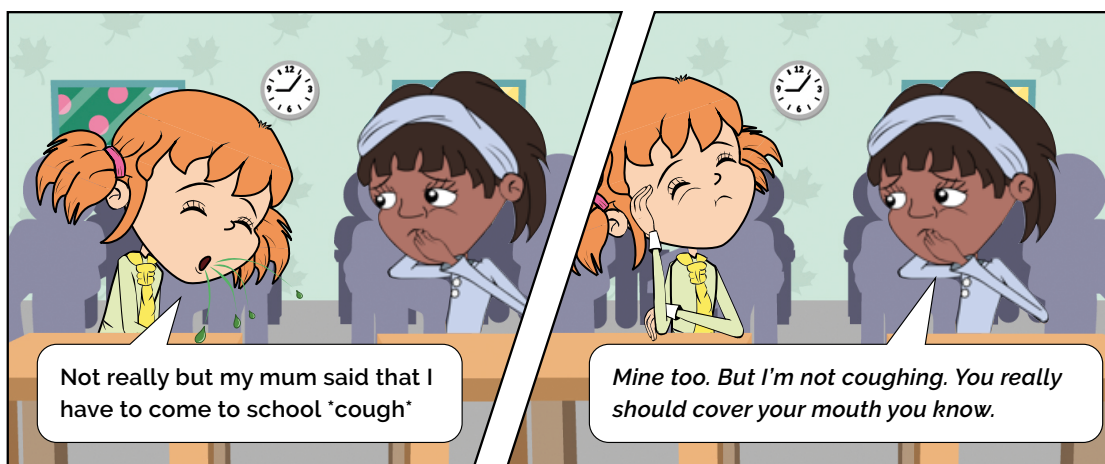


It is important for Luca to finish the course of antibiotics. Not finishing the course could result in the bacteria not being killed properly and becoming resistant to the antibiotic in the future.





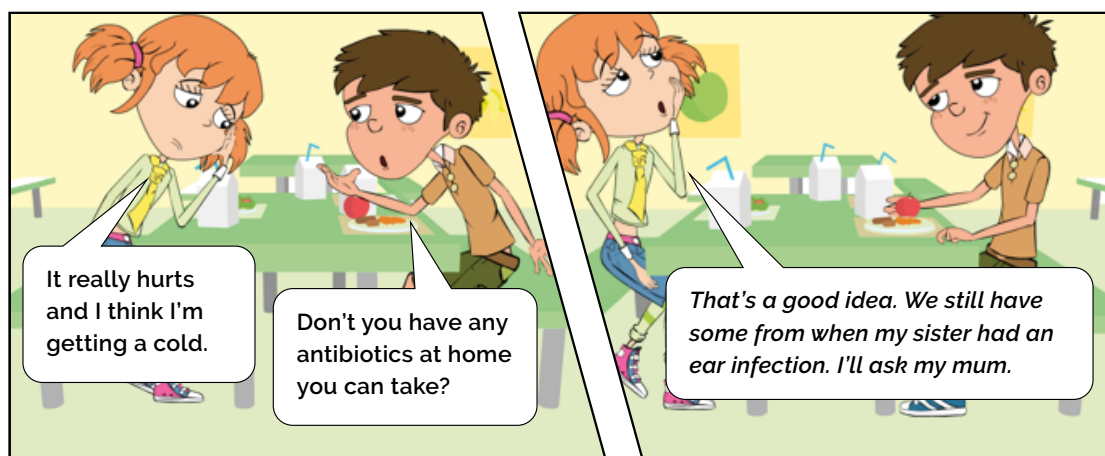
Ina went to school not feeling very well. She had a headache and a runny nose. When she arrived in the classroom she took a seat beside Eva. She soon realised that Eva was also not well.



At lunch time, Eva and Ina went to the toilet. Ina was hungry and in a hurry to have her lunch.

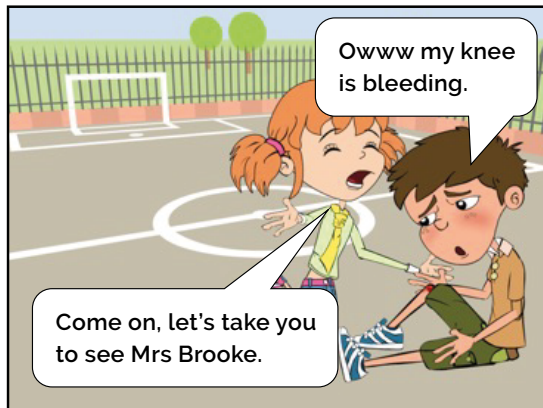


During lunch Eva was talking to her friend Luca about her headache and runny nose.

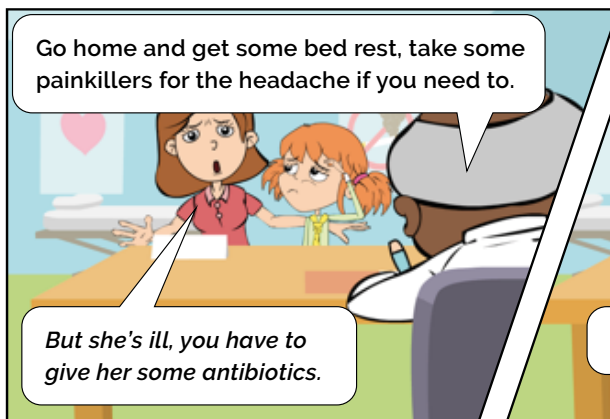




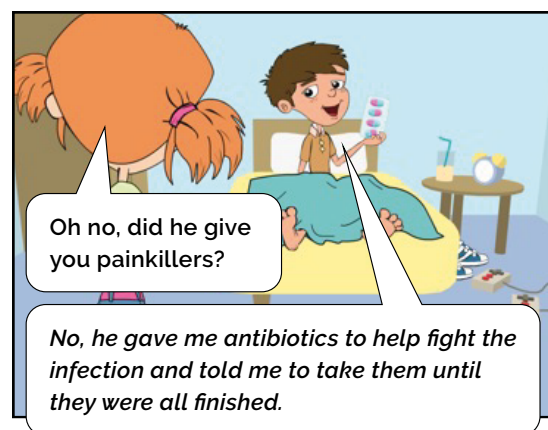
After they had eaten, the children went out to play.
Luca fell over and cut his knee very deeply.



When Eva got home, her mother decided to take her to the doctor.
Dr Cooper said that she had a bad cold.



A few days later, Luca didn't come to school, so Eva called around to see him on her way from school.






Harmful microbes make us ill

Yes or No




I can treat coughs and colds with antibiotics

Yes or No




I should always wash my hands after going to the toilet

Yes or No




If my friend is ill I can give them my old antibiotics

Yes or No




I should always cover my coughs and sneezes with a tissue

Yes or No




Most of the time my immune system can fight infections like the common cold by itself

Yes or No




If my doctor gives me antibiotics to take for 7 days but I feel better after 3 days I can stop taking them

Yes or No



Antibiotics only work on bacterial infections

Yes or No



I should only take antibiotics prescribed by my doctor

Yes or No





Word Mix Up

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

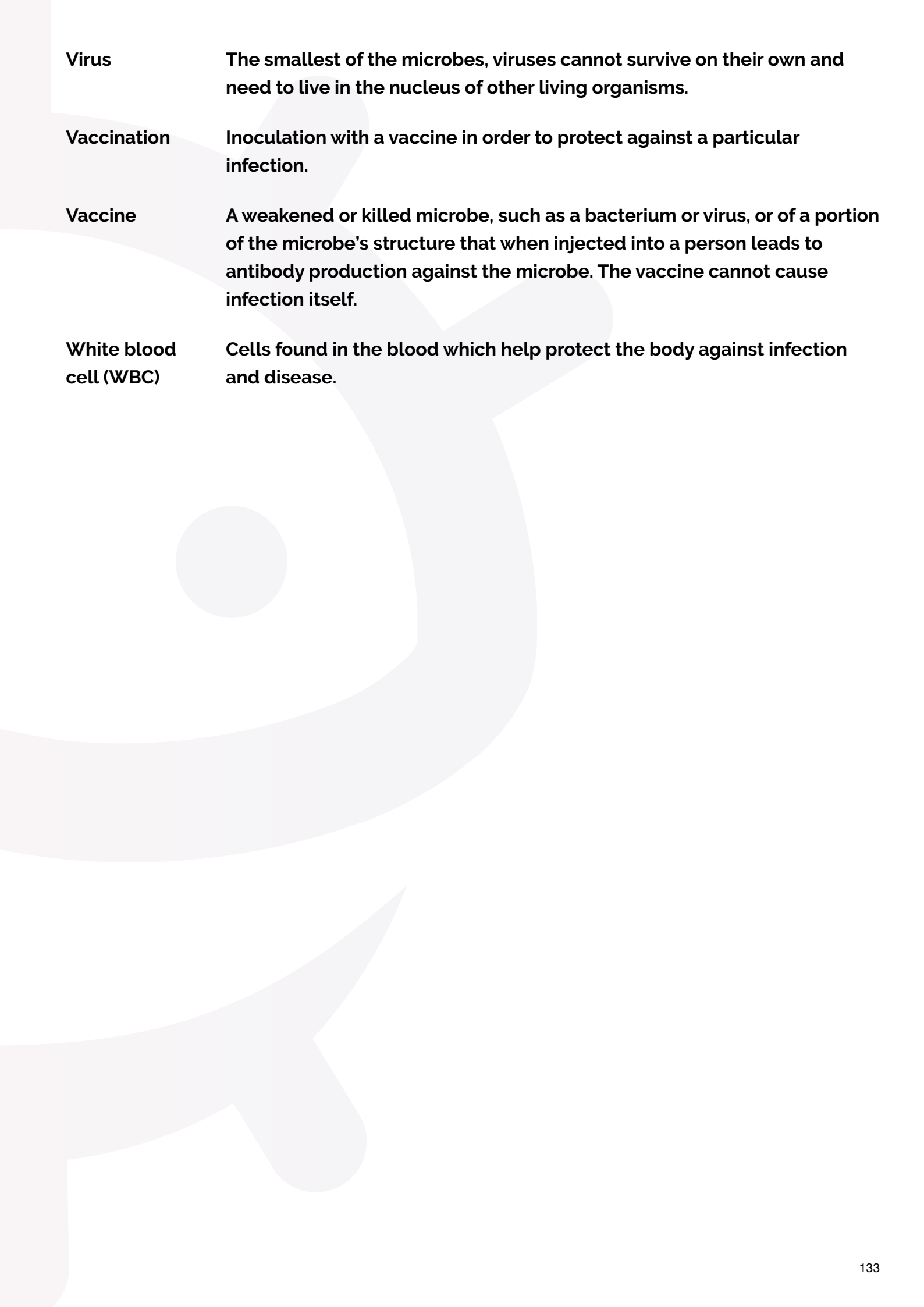


Glossary

Acid	Substance with a pH less than 7 produced by bacteria in the mouth that can dissolve the surface of teeth.
Antibacterial soap	A soap that kills some bacteria. Antibacterial soaps are being increasingly marketed but they have no added value over soap in the school setting.
Antibiotic	A type of medicine which is used to destroy or prevent the growth of bacteria.
Antibody	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.
Antigen	A special marker or part of a microbe that when introduced into the body stimulates the production of an antibody by white blood cells.
Bacteria	Microscopic single celled microbes that can be useful or harmful to humans. Bacterium is the singular of bacteria.
Bug	Another word for a microbe.
Caries	Another word for dental decay.
Cell	The smallest structural unit of an organism that is capable of working independently.
Colony	A group of microbes grown from a single parent cell.
Colonise	Ability to survive and grow on humans without necessarily causing harm.
Contagious	Able to be spread to others through direct or indirect contact.
Contamination	Impurity or uncleanness when an area or thing is covered with microbes.
Cross Contamination	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.
Culture	The growth of microbes in a specially prepared growth medium.

Dentine	Hard substance under the top layer of teeth (enamel) which surrounds the pulp (nerve) in the centre.
Dermatophytes	A group of fungi that like to grow in or on the skin and scalp.
Disease	An illness that has a group of signs or symptoms.
Erupt	The process of a tooth moving from below the gum into the mouth.
Exfoliate	When a baby tooth falls out naturally.
Experiment	A test carried out to observe whether or not an idea or theory is true.
Fermentation	A process by which microbes break down complex sugars into simple compounds such as carbon dioxide and alcohol.
Fluoride	An element which can protect teeth from tooth decay by strengthening the surface of teeth; can be found in toothpaste and mouthwashes.
Fungi	The largest of the microbes. Unlike bacteria or viruses, fungi are multi cellular.
Germ	Another word for harmful or pathogenic microbes.
Hygiene	Conditions and practices that serve to promote and preserve health and reduce spread of infection.
Illness	Poor health resulting from disease.
Immune system	The collection of organs, tissues, cells, and cell products such as antibodies that helps to remove microbes or substances from the body.
Immunise	Perform vaccinations or produce immunity by inoculation of a substance that is similar to part of the microbe you want to protect against.
Incubate	To maintain at the best temperature and conditions for growth and development.
Infection	A disease caused by a microbe.
Infectious	Capable of causing an infection. A person, animal or thing that can pass microbes on.
Inflammation	A protective attempt by the body to remove the microbe or unknown substance as well as initiate the healing process for the tissue.
Medicine	A substance, used to treat disease or injury.

Microbe	A shortened form of micro-organism.
Micro-organism	Living organisms that are too small to be seen with the naked eye.
Microscope	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.
Natural Barrier	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.
Natural Defence	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.
Pathogen	A microbe that can cause an illness.
Phagocytes	White blood cells which attack any foreign objects which enter the blood stream.
Phagocytosis	The method by which phagocytes engulf and digest unwanted microbes.
Plaque	A sticky yellow/white substance on teeth containing bacteria which builds up if we do not brush our teeth.
Plasma	The yellow coloured liquid of the blood in which the blood cells are suspended.
Prediction	An educated guess about future events.
Probiotic	Literally means 'for life'. Probiotics are bacteria that aid human digestion.
Results	The outcome or effect of an experiment.
Symptom	A sign of illness, e.g. headaches, fever and diarrhoea.
Tooth brushing	A technique to remove the plaque from teeth to prevent tooth decay
Toxin	A harmful substance produced by some harmful microbes.
Transfer	To move from one place to another. Spread of a microbe.
Transmission	Movement from one place to another.



Virus	The smallest of the microbes, viruses cannot survive on their own and need to live in the nucleus of other living organisms.
Vaccination	Inoculation with a vaccine in order to protect against a particular infection.
Vaccine	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.
White blood cell (WBC)	Cells found in the blood which help protect the body against infection and disease.

This project has been led by The Primary Care and Interventions Unit of the UK Health Security Agency

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Educating children in the areas of microbiology, hygiene and appropriate antibiotic use will help prevent antibiotics being exhausted in the future.

Children will grow up knowing when antibiotics should and shouldn't be used and understand effective hand and respiratory hygiene.

This resource pack has information, suggested lesson plans that can be adapted, and includes activities for you to use in your classroom to help you inspire and inform your pupils.

These resources cover topics in the Key Stage 2 National Curriculum such as "PSHE/ RSHE" and "Science" including "Working scientifically" and "Living things and their habitats".

This resource can be shared with PSHE teachers for use with Core Theme 1 – Health and prevention, which is part of the PSHE Association programme of study supported by the Department for Education.