Micro-organisms: Harmful Microbes



**Key Stage 3**

# Lesson 3: Harmful Microbes

In this lesson students will learn about some infectious diseases that cause problems in the world today.

## Learning Outcomes

### All students will:

* Understand that sometimes microbes can make us ill and cause infection.
* Understand that harmful microbes can pass from person to person.
* Understand that different infections cause different symptoms.
* Understand how global travel has influenced the spread of disease.

### Most students will:

* Understand how individuals, groups, and organisations work together when responding to infectious diseases outbreaks.

## Curriculum Links

### PHSE/RHSE

* Health and prevention

### Science

* Working scientifically
* Scientific attitudes
* Experimental skills and investigations

### Biology

* Structure and function of living organism
* Cells and organisation
* Nutrition and digestion

### English

* Reading
* Writing

**Lesson 3: Harmful Microbes**

## **Resources Required**

### Main activity: Infectious Disease Group Discussion

#### Per Class/Group

* Copy of SH1, SH2, SH3
* Copy of SW1
* Differentiated versions for students of different abilities SH4, SH5, SW2

## Supporting Materials

* TS1 Microscopic Yoghurt Teacher Sheets
* SH1 How to Make Yoghurt Instructions
* SW1 Yoghurt Experiment: Observation Sheet
* SW2 Microscopic Yoghurt: Observation Sheet

## Advanced Preparation

1. 1. Cut out the disease cards in SH1 - SH3, one set per group. Laminate or stick on to stiff card for future use. (Differentiated version: SH4 – SH5).
2. Copy SW1 for each group. (Differentiated version: SW2).
3. Copy TS1 - TS2 teacher answers.

. **Lesson 3: Harmful Microbes**

## Key Words

Bacteria

Dermatophytes

Fungi

Infection

Pathogens

Toxin

Virus

## **Health & Safety**

For safe microbiological practices in the classroom consult CLEAPPS

[www.cleapps.org.uk](http://www.cleapps.org.uk)

## **Weblinks**

e-bug.eu/eng/KS3/lesson/ Harmful-Microbes

## Introduction

1. Begin the lesson by explaining to the class that sometimes microbes can be harmful to humans. Bacteria can produce toxins when they reproduce which are harmful to the body. Viruses enter the body and stick to the cell surface multiplying inside our cells and destroying them. Some fungi like to grow on our skin making it itchy and sore. Find out how many different words students know for microbes – germs, bugs, etc.
2. Ask the class to create a list of infections (infectious diseases) by brainstorming any diseases they have heard of. Do they know what microbes cause the diseases? Ask the students what disease they think poses a threat to students in the class today? Tell them that in the early 1900s the disease of greatest threat was measles; many children who caught measles then died of the disease. Thankfully today we now have a vaccine to prevent this.
3. Tell the class that bacteria and other microbes that can cause infection and which can spread easily from person to person are called infectious. Discuss the difference between an infectious microbe and a non-infectious one. An example of a non-infectious microbe is the *Lactobacilli* bacteria we learned about in lesson 2. Discuss with students the various routes of transmission, i.e. touch, water, food, body fluid and air. Identify any infectious diseases mentioned in the brainstorming session and how they are transmitted.

## Activity

### Main Activity: Infectious Disease Group Discussion

1. This activity should be carried out in groups of 3 – 5 people. Explain that during this activity students are going to learn about some infectious diseases that cause problems in the world today.
2. Provide each group with the disease cards found in SH1 – SH3. (Differentiated version: SH4 – SH5)
3. Tell the class that sometimes scientists need to group diseases under different headings to address different problems. Each group should examine the headings on SW1. (Differentiated version: SW2)
4. Ask each group to complete SW1 (Differentiated version: SW2) for the first heading – Infectious microbe. After a few minutes, ask a spokesperson in each group to read out their results. Write all the results on a white board for discussion.
5. After each heading in SW1/2 has been completed, discuss the class results.
   1. Infectious organism: Remind students that there are three main types of microbes. It is important to identify the microbe causing the disease in order to treat the disease properly, e.g. antibiotics cannot be used to treat viruses (this will be covered in lesson 9 of the resource).
   2. Symptoms: Students may notice that some diseases exhibit similar symptoms, e.g. fever or rash. You may wish to discuss how important it is for people to visit their doctor when they are ill to receive a correct and accurate diagnosis.
   3. Transmission: Many diseases are transmitted very easily through touch or by inhalation. Other diseases are quite specific and require the transfer of blood or other bodily fluids.
   4. Preventative measures: People can prevent the spread of, and protect themselves against, infection by employing a few simple steps. Regular hand washing and covering our coughs and sneezes has been shown to reduce the incidence of many common infections. The correct use of a condom can reduce the transmission of many STIs. Vaccines are used to prevent certain infections, many of which were once more common than today.
   5. Treatment: It is important to note here that not all illnesses require medical treatment; some require bed rest and an increased fluid intake; however, painkillers may be used to alleviate some of the symptoms. Highlight to the students that antibiotics are only used to treat bacterial infections.

## Discussion

### What is a disease?

**Answer**: An illness or sickness characterised by specific signs or symptoms.

### What is an infectious disease?

**Answer**: An infectious disease is a disease that is caused by a microbe and can be spread to other people.

### Why do we see infectious diseases that used to be found in a single region, all over the world today?

**Answer**: Many infectious diseases start in a specific region or country. In the past the infection could easily be contained or isolated. Today, however, people travel faster, more frequently and further than ever before. A person travelling from Australia to England can make the journey in under a day, stopping off at Hong Kong en route. If this person has a new strain of the flu virus, they could spread it to anyone they came into contact with on the plane, people they come into contact with at Hong Kong airport and people they came into contact with when they landed in England. These people could also carry the flu to other people they come into contact with all over the world. Within a few days, this new strain of influenza virus could be found worldwide!!! You may want to discuss how quickly the virus causing the disease COVID-19 spread around the world.

### Fascinating Fact

According to the WHO, the top 10 causes of death in 2019 accounted for 55% of the 55.4 million deaths worldwide. Four out of ten were caused by infectious diseases.

Check for understanding by asking students the following questions:

## Learning Consolidation

Ask students to write a paragraph or three statements to summarise what they have learned during the lesson.



## TS1 – Disease Match Answer Sheet

Answer Sheet

|  |  |
| --- | --- |
| 1.Infectious Microbe | Disease |
| Bacteria | Bacterial meningitis, Chlamydia, MRSA |
| Virus | HIV, Chickenpox, Flu, Measles, Glandular fever |
| Fungi | Thrush |

|  |  |
| --- | --- |
| 2.Symptoms | Disease |
| Asymptomatic | Chlamydia, MRSA |
| Fever | Flu, Measles, Chickenpox, Bacterial meningitis |
| Rash | Bacterial meningitis, Chickenpox, Measles |
| Sore throat | Flu, Glandular fever |
| Tiredness | Glandular fever |
| Lesions | HIV |
| White discharge | Chlamydia, Thrush |

|  |  |
| --- | --- |
| 3.Transmission | Disease |
| Sexual contact | Chlamydia, HIV, Thrush |
| Blood | Bacterial meningitis, HIV |
| Touch | Flu, Measles, Chickenpox, MRSA |
| Inhalation | Flu, Measles, Chickenpox, Bacterial meningitis |
| Mouth to mouth | Flu, Glandular fever |

|  |  |
| --- | --- |
| 4. Prevention | Disease |
| Wash hands | Flu, Measles, Chickenpox, MRSA, Bacterial meningitis |
| Cover coughs and sneezes | Flu, Measles, Chickenpox, Bacterial meningitis |
| Use a condom | Chlamydia, HIV, Thrush |
| Avoid unnecessary antibiotic use | MRSA, Thrush |
| Vaccination | Chickenpox, Measles, Flu |

|  |  |
| --- | --- |
| 5. Treatment | Disease |
| Antibiotics | Chlamydia, Bacterial meningitis, MRSA |
| Bed rest | Chickenpox, Glandular fever, Measles, Flu |
| Antifungals | Thrush |
| Fluid intake | Chickenpox, Glandular fever, Measles, Flu |

Point to note: MRSA is an antibiotic resistant bacterium, it is specifically resistant to methicillin and some other commonly used antibiotics. Its resistance status is attributed to the overuse and misuse of this and other antibiotics. Treatment is still via antibiotic therapy, however, MRSA is also developing resistance to these as well.



## TS2 – Disease Match Differentiated Answer Sheet

Answer Sheet

|  |  |
| --- | --- |
| 1. Infectious Microbe | Disease |
| Bacteria | Chlamydia |
| Virus | Chickenpox, Flu, Measles, |
| Fungi | Thrush |

|  |  |
| --- | --- |
| 2. Symptoms | Disease |
| Asymptomatic | Chlamydia, |
| Fever | Flu, Measles, Chickenpox, |
| Rash | Chickenpox, Measles |
| Sore throat | Flu |
| White discharge | Chlamydia, Thrush |

|  |  |
| --- | --- |
| 3. Transmission | Disease |
| Sexual contact | Chlamydia, Thrush |
| Touch | Flu, Measles, Chickenpox |
| Inhalation | Flu, Measles, Chickenpox |
| Mouth to mouth | Flu |

|  |  |
| --- | --- |
| 4. Prevention | Disease |
| Wash hands | Flu, Measles, Chickenpox |
| Cover coughs and sneezes | Flu, Measles, Chickenpox |
| Use a condom | Chlamydia, Thrush |
| Avoid unnecessary antibiotic use | Thrush |
| Vaccination | Chickenpox, Measles, Flu |

|  |  |
| --- | --- |
| 5. Treatment | Disease |
| Antibiotics | Chlamydia |
| Bed rest | Chickenpox, Measles, Flu |
| Antifungals | Thrush |
| Fluid intake | Chickenpox, Measles, Flu |



## SH1 - Disease Match Information Sheet

Methicillin Resistant *Staphylococcus aureus* (MRSA)

|  |  |
| --- | --- |
| Infectious agent | Bacterium: *Staphylococcus aureus* |
| Symptoms | Asymptomatic in healthy individuals. Can cause skin infections, infect surgical wounds, the bloodstream, the lungs, or the urinary tract in previously ill patients. |
| Diagnosis | Swab and antibiotic sensitivity test. |
| Mortality rate | High – if not given the correct antibiotics. |
| Transmission | Contagious. Direct skin contact. |
| Prevention | Regular hand washing. |
| Treatment | Resistant to many antibiotics. While some antibiotics still work, MRSA is constantly adapting. |
| History | First reported 1961, increasing problem globally. |

Measles

|  |  |
| --- | --- |
| Infectious agent | Virus: *Paramyxovirus* |
| Symptoms | Fever, runny nose, red and runny eyes, a cough, a red rash and a sore, swollen throat. |
| Diagnosis | Blood sample and antibody test. |
| Mortality rate | Low, but can be high in lower income countries, where treatment can be hard to access. |
| Transmission | Contagious. Droplets from coughs and sneezes, skin contact or contact with objects that have the live virus on them. |
| Prevention | Prevention via vaccination. |
| Treatment | Bed rest and fluid intake. |
| History | Virus first reported 1911, has decreased dramatically in high and middle income countries in recent years although small epidemics do occur. Still a pandemic  problem for low income countries. |



## SH2 - Disease Match Information Sheet

Flu

|  |  |
| --- | --- |
| Infectious agent | Virus: *Influenza* |
| Symptoms | Headache, fever, chills, muscle aches; possibly sore throat, cough, chest pain. |
| Diagnosis | Blood sample and antibody test. |
| Mortality rate | Medium but higher in the very young and elderly. |
| Transmission | Highly contagious. Inhalation of viruses on airborne particles. Direct skin contact. |
| Prevention | Vaccination against current strains. |
| Treatment | Bed rest and fluid intake. Antivirals in the elderly. |
| History | Present for centuries, epidemics occur at regular intervals. |

Thrush

|  |  |
| --- | --- |
| Infectious agent | Fungus: *Candida albicans* |
| Symptoms | Itching, burning, soreness and white coating of the mouth or irritation of the vagina with a whitish discharge. |
| Diagnosis | Swab, microscopic examination and culturing. |
| Mortality rate | None. |
| Transmission | Person to person contact but is a normal part of the flora of the gut. |
| Prevention | Symptoms are caused by overgrowth of this fungus due to antibiotics killing off the normal protective bacteria. Therefore avoid unnecessary antibiotic use. |
| Treatment | Antifungals |
| History | Almost 75% of all women have had this infection at least once. |



## SH3 - Disease Match Information Sheet

Chlamydia

|  |  |
| --- | --- |
| Infectious agent | Bacterium: *Chlamydia trachomatis* |
| Symptoms | In many cases there are no symptoms but sometimes there is a discharge from the vagina or penis. Swollen testicles and inability to have children can also occur. |
| Diagnosis | Swab or urine sample for molecular testing. |
| Mortality rate | Rare |
| Transmission | Contagious through sexual contact. |
| Prevention | Use a condom during sexual intercourse. |
| Treatment | Antibiotics |
| History | First discovered in 1907. Global problem which is on the increase. |

Bacterial Meningitis

|  |  |
| --- | --- |
| Infectious agent | Bacterium: *Neisseria meningitidis* |
| Symptoms | Headache, neck stiffness, high fever, irritability, delirium, rash. |
| Diagnosis | Spinal fluid sample and molecular testing. |
| Mortality rate | Medium – higher risk in the young and elderly. |
| Transmission | Contagious, through saliva and inhalation of droplets. |
| Prevention | Vaccination against many strains, avoid contact with infected patients. |
| Treatment | Penicillin, oxygen and fluids. |
| History | First identified as a bacteria in 1887. Regular epidemics in low income countries. |

HIV/AIDS

|  |  |
| --- | --- |
| Infectious agent | Virus: *Human immunodeficiency virus* (HIV). |
| Symptoms | Failing immune system, pneumonia, lesions. |
| Diagnosis | Blood sample and antibody test. |
| Mortality rate | Medium – high in countries where access to HIV testing and anti-HIV drugs is limited. |



## SH4 - Disease Match Information Sheet

HIV/AIDS

|  |  |
| --- | --- |
| Transmission | Highly contagious. Sexual contact, blood to blood contact, sharing of needles, mother to new born transmission. |
| Prevention | Always wear a condom during sexual intercourse. |
| Treatment | There is no cure although anti-HIV drugs can prolong life expectancy. |
| History | First identified in 1983. Currently a global epidemic. |

Glandular fever (Kissing Disease)

|  |  |
| --- | --- |
| Infectious agent | Virus: *Epstein Barr* |
| Symptoms | Sore throats, swollen lymph glands, extreme tiredness. |
| Diagnosis | Blood sample and antibody test. |
| Mortality rate | Low |
| Transmission | Not very contagious. Direct contact such as kissing and sharing drinks. |
| Prevention | Avoid direct contact with infected patients. |
| Treatment | Bed rest and fluid intake, paracetamol can be used to relieve the pain. |
| History | First described in 1889, 95% population have had the infection, however, only 35% develop symptoms. Occasional isolated outbreaks. |

|  |  |
| --- | --- |
| Infectious agent | Virus: *Varicella-zoster* |
| Symptoms | Blistering rash on the body and head. |
| Diagnosis | Blood sample and antibody test. |
| Mortality rate | Low |
| Transmission | Highly contagious. Direct skin contact or inhalation of droplets from sneezing and coughing. |
| Prevention | Prevention by vaccine. |
| Treatment | Bed rest and fluid intake, antivirals in some adult cases. |
| History | First identified in 1865. Decreased in countries where vaccination programmes have been implemented. No change elsewhere. |

Chickenpox

|  |  |
| --- | --- |
| Microbe | Virus: *Paramyxovirus* |
| Symptoms | Fever, runny nose, red and runny eyes, a cough, a red rash and a sore, swollen throat. |
| Transmission | Spread in coughs and sneezes.  Skin contact.  Touching objects that have the live virus on them. |
| Prevention | Vaccination.  Handwashing. |
| Treatment | Bed rest and fluid intake. |



## SH5 - Disease Match Differentiated Information Sheet

Measles

|  |  |
| --- | --- |
| Microbe | Virus: *Influenza* |
| Symptoms | Headache, fever, chills, muscle aches; possibly sore throat, cough, chest pain. |
| Transmission | Spread in coughs and sneezes.  Breathing in virus in the air.  Touching objects that have the live virus on them. |
| Prevention | Vaccination against current strains. |
| Treatment | Bed rest and fluid intake.  Antivirals in the elderly. |

Flu

|  |  |
| --- | --- |
| Microbe | Fungus: *Candida albicans* |
| Symptoms | Itching.  Burning.  Soreness.  White coating of the mouth or irritation of the vagina with a whitish discharge. |
| Transmission | Person to person contact. |
| Prevention | The fungus that causes symptoms can grow better when our natural bacteria are killed off. Therefore, avoid unnecessary antibiotic use. |
| Treatment | Antifungals |

Thrush



## SH6 – Disease Match Differentiated Information Sheet

Chlamydia

|  |  |
| --- | --- |
| Microbe | Bacterium: *Chlamydia trachomatis* |
| Symptoms | In many cases there are no symptoms but sometimes there is a discharge from the vagina or penis.  Swollen testicles.  Inability to have children can also occur. |
| Transmission | Sexual contact. |
| Prevention | Use a condom during sexual intercourse. |
| Treatment | Antibiotics. |

Chickenpox

|  |  |
| --- | --- |
| Microbe | Virus: *Varicella-zoster* |
| Symptoms | Blistering rash on the body and head. |
| Transmission | Direct skin contact.  Spread in coughs and sneezes.  Breathing virus in the air. |
| Prevention | Vaccination.  Handwashing. |
| Treatment | Bed rest and fluid intake.  Antivirals in some adult cases. |



## SW1 – Disease Match Worksheet

Disease Match

Procedure:

1. Group your disease cards according to the heading in each box.

2. Do you notice any similarities or differences between the diseases based on each of the headings?

|  |  |
| --- | --- |
| 1.Infectious Microbe | Disease |
| Bacteria |  |
| Virus |  |
| Fungi |  |

|  |  |
| --- | --- |
| 2.Symptoms | Disease |
| Asymptomatic |  |
| Fever |  |
| Rash |  |
| Sore throat |  |
| Tiredness |  |
| Lesions |  |
| White discharge |  |

|  |  |
| --- | --- |
| 3.Transmission | Disease |
| Sexual contact |  |
| Blood |  |
| Touch |  |
| Inhalation |  |
| Mouth to mouth |  |

|  |  |
| --- | --- |
| 4. Prevention | Disease |
| Wash hands |  |
| Cover coughs and sneezes |  |
| Use a condom |  |
| Avoid unnecessary antibiotic use |  |
| Vaccination |  |

|  |  |
| --- | --- |
| 5. Treatment | Disease |
| Antibiotics |  |
| Bed rest |  |
| Antifungals |  |
| Fluid intake |  |



## SW2 – Differentiated Disease Match Worksheet 1/2

Disease Match

Procedure:

1. Use the information sheets to find out with diseases should go in each empty box. This has been started for you.

2. Do you notice any similarities or differences between the disease?

|  |  |
| --- | --- |
| 1. Infectious Microbe | Disease |
| Bacteria | Chlamydia |
| Virus | 1  2  3 |
| Fungi | 1 |

|  |  |
| --- | --- |
| 2. Symptoms | Disease |
| Asymptomatic | 1 |
| Fever | 1  2  3 |
| Rash | 1  2 |
| Sore throat | 1  2 |
| White discharge | 1  2 |

|  |  |
| --- | --- |
| 3. Transmission | Disease |
| Sexual contact | 1  2 |
| Touch | 1  2  3 |
| Inhalation | 1  2  3 |
| Mouth to mouth | 1 |



## SW2 – Differentiated Disease Match Worksheet 2/2

Disease Match

|  |  |
| --- | --- |
| 4. Prevention | Disease |
| Wash hands | 1  2  3 |
| Cover coughs and sneezes | 1  2  3 |
| Use a condom | 1  2 |
| Avoid unnecessary antibiotic use | 1 |
| Vaccination | 1  2  3 |

|  |  |
| --- | --- |
| 5. Treatment | Disease |
| Antibiotics | 1 |
| Bed rest | 1  2  3 |
| Antifungals | 1 |
| Fluid intake | 1  2  3 |