

# Infection

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## ***Acknowledgements***

This resource was originally developed by the University of Reading to support outreach work delivered as part of the Chemistry for All project.

To find out more about the project, and get more resources to help widen participation, visit our Outreach resources hub: [rsc.li/3CJX7M3](https://rsc.li/3CJX7M3).

## Learning objectives

By the end of this session, you will be able to:

- Explain how infections spread between humans.
- Describe some methods of preventing and fighting infections.

### Career link

#### *University laboratory technician apprentice*

Meet Tyler, a university laboratory technician apprentice who works with university students by supporting them with their research into infectious diseases such as Covid-19 and long-term conditions such as lung diseases. Her career profile is available on **slide 4** and also at [rsc.li/3ZpW6mE](https://rsc.li/3ZpW6mE).

## Activity 1: spreading the infection

Infectious diseases are those that can be spread from person to person through contact.

In this activity you will be modelling the spread of an infectious disease using solutions in cups.

One learner has hydrochloric acid and the rest of you have only water.

As you go round the room and interact with the other learners, you will transfer five drops of your solutions to each other's cups.

At the end of the activity you will add universal indicator solution to your cup to see whether you have any acid present.

The learners who have acid in their cups represent those who have become 'infected' by the original source of infection (the learner who first had the acid solution).

### Equipment

- Plastic cup with 50 ml water or 50 ml 1 M hydrochloric acid
- Universal indicator solution
- Pasteur pipette

### Safety and hazards

Wear safety glasses.

Wash your hands if you come into contact with the solutions contained in the cups to avoid irritation.

### To do

1. Interact with other learners, eg shake hands and say 'Hello'.
2. Every time you interact with another learner, transfer five drops of solution from your cup to theirs using your pipette. The other learner will transfer five drops of their solution into your cup.
3. Use your empty pipette to stir your solution and move on to the next learner.
4. If you meet the same learner twice add another five drops.
5. Repeat this process until your teacher tells you to return to your seat.
6. Add 2–3 drops of universal indicator solution to your cup.

**To answer**

- (a) Describe the colour of your solution after adding the universal indicator. Did you have any acid present in your cup?

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- (b) How can the source of the acidity ('infection') be identified using the colour of the solution?

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- (c) The level of 'infection' in the class can be determined by working out the number of learners whose solutions increased in acidity. What is the level of 'infection' in your group (eg the % of individuals 'infected')?

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## Career link

### Medicinal chemist

Watch John's video job profile, available on **slide 9** and from [rsc.li/3IUNNbf](https://rsc.li/3IUNNbf). He is a medicinal chemist who works on the discovery and development of drugs to treat infectious diseases such as malaria and tuberculosis.

## Activity 2: chemicals against infection

### To do

You will be given a set of cards to sort. Half of the cards show treatments used to deal with infectious diseases and the other half show situations where that treatment is used. These include treatments developed by scientists, as well as natural treatments.

Use the information provided below to help you to match up each type of treatment with its correct use.

**Gold nanoparticles** were first discovered by Michael Faraday in the 1850s. However, it wasn't until 1898 that the first colloidal gold in solution was prepared by Richard Zsigmondy. These nanoparticles kill *E. coli* by breaking down the bacterial cell wall.

**Titanium oxide nanoparticles** are used to coat biomedical devices to help prevent infection. They have self-cleaning and self-disinfection properties; this works through oxidation, which makes it non-toxic yet still extremely effective at killing bacteria.

**Iron oxide nanoparticles** are non-toxic and easily degradable so are good for taking orally. They help supply drugs to certain areas of the body to target infection. They can also be used to administer drugs to target certain cancers such as breast cancer.

**Zinc oxide nanoparticles** are applied as a coating to surfaces. They interfere with the metabolic processes in bacteria. They are effective against *staphylococcus*, which can cause MRSA.

**Honey** has been used in wound dressing for thousands of years. Its high viscosity helps to provide a protective barrier to prevent infection; it has antibacterial properties and also helps wounds to stay moist.

## Infection: student workbook

Available from [rsc.li/3uUoCiQ](https://rsc.li/3uUoCiQ)

**Tea tree oil** is used to fight *staphylococcus*, which can cause MRSA. It contains a chemical called terpinen-4-ol that has antimicrobial activity.

**Carbon nanotubes** can detect the ammonia that is generated by the bacteria which cause infections. They can be used in dressings to indicate infections in wounds.

**Garlic** contains ajoene, which kills the bacteria that cause infections. Ajoene can prevent infections in the mucus collecting in the lungs of cystic fibrosis patients. It stops bacteria from communicating with one another and prevents the bacteria secreting a substance that destroys the body's white blood cells.

### Career link

#### Associate scientist

Meet Holly, an associate scientist specialising in pharmaceuticals. Watch the video on **slide 14**, also available from [rsc.li/3SVe4Lu](https://rsc.li/3SVe4Lu), to find out about her work on the development of new medicines to treat diseases.