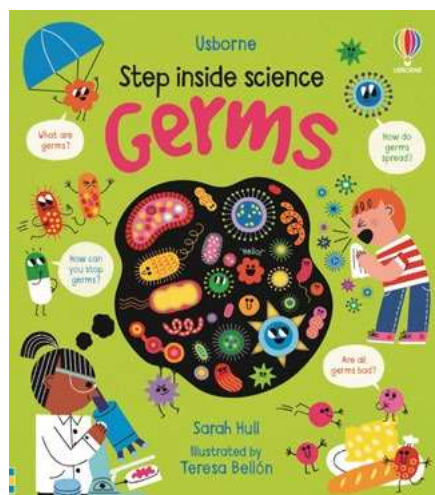


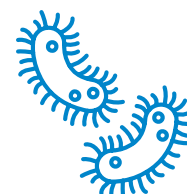
# GERMS

## Pupil activity sheet

This is one of a series of six activity sheets to use alongside the books which have been shortlisted for the Royal Society Young People's Book Prize 2023.



We hear a lot about germs but what are they? Delve into the microscopic world of viruses and bacteria to find out how they spread and some of the useful things they do for us in Step inside science: Germs. Written by Sarah Hull and Illustrated by Teresa Bellón.



### Words of wisdom

'Germs' is a word scientists use when talking about a group of microscopic organisms. Here are some other scientific words and phrases used in the book. They might be completely new to you, or maybe you just need to improve your understanding of how they are used by scientists. When we feel poorly, we often use phrases like, 'It hurts', 'Tummy bug', or 'Feeling sick', but scientists use specific terms to talk about illness and how we get better.

Working with a partner, pick out the terms you understand fully and have a go at using them in a sentence. Listen carefully to each other to check you are using the terms correctly. Can you use two or more words in the one sentence? Use a dictionary or search online to find the meaning of those terms you are less sure of. When you can explain the terms to someone else you are ready to use them in your investigations.

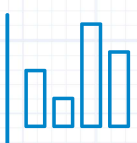
virus	bacteria	infection
diseases	antibodies	white blood cells
antibiotics	vaccine	microscopic

"Most germs are HARMLESS, which is lucky, because they really ARE everywhere! There are MILLIONS and BILLIONS and TRILLIONS of germs on planet Earth."

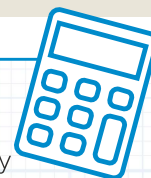
*Germs*

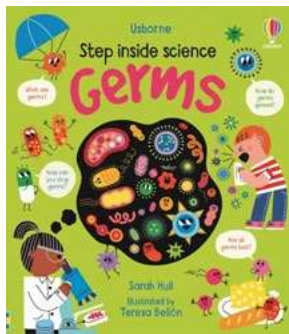
### Mathematics challenge

Once you have carried out your filtration investigation, you will have a set of results showing how quickly different materials were able to filter your mixture. Can you create a bar chart or other mathematical way of sharing your results with others?



Did you come up with an effective way to measure how clear the filtered water was? Perhaps you used a 1-10 scale and ranked each material, or maybe you used data loggers to measure how much light could pass through the mixture. With two sets of numerical data, you can create a line graph to see if there is any link between the time taken to filter, and how clear the water is at the end.





# GERMS

## Pupil activity sheet (continued)

### Making marvellous medicines

When a doctor prescribes you a medicine, how do they know it will help you get better? We trust medical professionals to provide drugs they know are safe for us to use but who is responsible for making sure? Before treatments can be recommended by our doctors, they must be tested in clinical trials (carefully monitored tests) to see what effect they have on how volunteers respond. Research online to find out how medicines are discovered, tested, and made safe for patients. Have a group discussion to share what you have found out. Was this something you had thought about before? Did anything surprise you? Do you feel reassured by what you have discovered?



### Scientist profile

Meet Professor Dame Sarah Gilbert, a professor of vaccinology at the University of Oxford. 'ology' at the end of a word refers to a type of science. Vaccinology is the science of developing new vaccines to help prevent major global infectious diseases.



In 2020, Sarah led a team of people who helped create the Oxford / Astra Zeneca COVID-19 vaccine in record time and helped save millions of lives around the world. In recognition of this achievement, she was made a Dame, a special award, given by Queen Elizabeth II, for her services to science and public health.

Recognising her vital work during the pandemic, toy company Mattel even created a Barbie doll in her image which she hopes will inspire more young girls to pursue a career in science. Sarah's Barbie is one of six, celebrating other women involved in the coronavirus response, including doctors, nurses, and medical researchers.



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### Marketing medicine

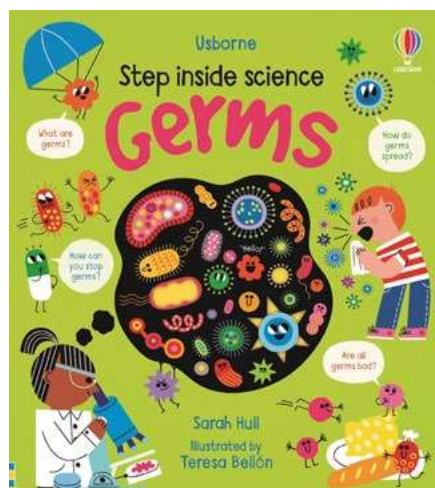
When your cough syrup recipe is finalised, take another look at the medicine packaging your teacher shared with you and search online for examples of cough syrup adverts. How do they try to sell them to customers? What words do they use? What images do they show? How do they use colours? Work with a group to come up with an advertising poster or video which you could use to persuade people to buy your cough syrup. A script or storyboard might come in useful.



# GERMS

## Teacher activity sheet

This is one of a series of six activity sheets to use alongside the books which have been shortlisted for the Royal Society Young People's Book Prize 2023.



Each activity sheet contains ideas for experiments to do with your pupils, provides information relating to careers, and has a maths focus to help pupils understand the importance of mathematics education across the curriculum.

These investigations can be done as standalone activities or carried out as an in-depth sequence to develop pupils' disciplinary and substantive knowledge. The pupils' deeper learning and their science capital development would be more memorable if they were able to collaborate with a scientist such as a microbiologist or virologist. If you work with a scientist in this way you could also consider applying for a [Royal Society Partnership Grant](https://royalsociety.org/partnership) of up to £3,000. For more information and to apply, visit: [royalsociety.org/partnership](https://royalsociety.org/partnership)

### How can some germs make us poorly and some germs make us better?

Rest, fluids, and over-the-counter painkillers are some of the recommended remedies for common viral infections like coughs and colds. To treat infections caused by bacteria, like strep throat and scarlet fever, we may need a doctor to prescribe antibiotics, drugs used to kill the living bacteria that cause the problem. But where do antibiotics come from?

Take your class on a journey through the medicine development process from growing microbes to tablet design.

### Investigating food sources for microbes

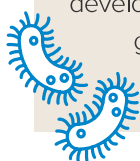
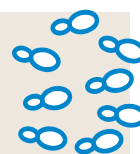
Have the pupils take on the role of expert scientists working on behalf of a pharmaceutical company, or real-life microbiologist, to research and design a new cough syrup. Begin by exploring a range of empty and clean medicine packaging where you will discover that the recipe for medicines contains an *active ingredient*; the part that helps people feel better.

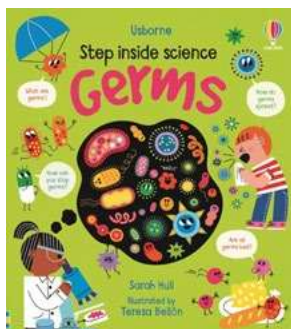
Some microbes are good for us and produce substances that kill other microbes which are bad for us. The substance they create can be used as the active ingredient in medicines. Replicate this stage of medicine design by challenging pupils to

investigate a range of suitable food sources for growing a good, classroom-safe, microbe they may be familiar with; yeast. The aim is to find the best food source for growing the microbe.

Pupils mix yeast inside small plastic bottles with different food sources (flour, salt, sugar, and lemon juice), add hot water (approx. 50°C) and see which food source helps the yeast grow best.

Growing yeast releases carbon dioxide (just as we do). Capture this in balloons so pupils can see if their food source has been effective.



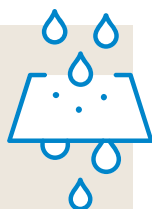


# GERMS

## Teacher activity sheet (continued)

### Filtering the active ingredient

A mixture of flour and water creates a classroom-safe replica of your food source investigation for stage two of medicine development, filtering. Ask pupils to consider how they will separate the solid waste (flour) from the liquid (water) containing the active ingredient. Which materials might make a good filter? How will they test them? When concluding which filter material is best, pupils might consider how long the filtering process takes and how much of the flour is removed from their sample.



### Cough syrup viscosity

The final stage is recipe design. Challenge pupils to develop a recipe which could be mixed with the active ingredient to make the final product. Consistency is important; the cough syrup needs to be runny enough to pour from a bottle but thick enough to coat a patient's throat. Pupils could explore a range of different liquids and devise a way to measure their viscosity. How can they test runniness? What equipment do they plan to use? What consistency will they aim for? Mixing liquid glucose, glycerine, and water in various ratios, ask your class to find the ideal recipe.



### Taking it further

Scan the QR code to access the free resource [Cough Syrup](#) which includes detailed planning and pupil sheets to support these activities.



And if your class has enjoyed exploring the medicine development process, the free resource [Medicine for Pets](#) has further investigations into medicine development, designing tablet shapes, creating tablet coatings and more.



### Career links

- Microbiologists**  
study microorganisms (microbes) so they can understand how they affect our lives and how they can be useful to us. Their work helps to solve problems affecting our health, the environment, the climate, and the food we eat.
- Virologists**  
are a special type of microbiologist who study illnesses caused by viruses like the common cold, influenza (the flu), and COVID-19. As well as diagnosing and researching treatments for viral infections, they may track the cause and spread of viruses and research potential vaccines. Bacteriologists do a similar job for illnesses caused by bacteria.
- Food scientists**  
make sure that the food and drinks we consume meet our country's safety and quality standards. They study the properties of food such as colour, flavour, texture, and nutritional value. It's important that they know about different types of mould, yeast, and bacteria that could be harmful.

