SIEMENS

KS3

SIEMENS SMART BUILDINGS

# What are bacteria?

Bacteria are some of the smallest living things in our world and like all living things, they are made up of cells. You'll have a hard time spotting them with the naked eye though, as most cells are so small that you can only see them under a microscope.

There are millions of different types of bacteria, good and bad, and they can live on their own. Not all bacteria are harmful and in fact, good bacteria exist inside your very own body - like intestinal flora, which helps your gut to digest food.

### Did you know?

**You can find good bacteria in foods like yoghurt and cheese, which help to promote healthy gut bacteria.**

On the other hand, harmful types of bacteria also exist that can cause diseases including food poisoning, meningitis and scarlet fever. Inside the body, these bacteria reproduce quickly and can create poisons that make you feel ill.

### Did you know?

**You can usually kill bacteria using drugs like antibiotics.**

### What are bacteria made of?

Similar to plant and animal cells, most bacteria are microscopic organisms that share a cell membrane and cytoplasm. Bacteria also have a cell wall around them, like plant cells. However unlike most plant and animal cells, they have no nucleus. Instead, they have a circular strand of DNA, called a plasmid, that floats in the cytoplasm.

Bacteria can take lots of different shapes and cell structures to help them to survive. For example, they may have:

- Flagella, which are tail-like structures that allow bacteria to move through liquids.
- A slime capsule, outside the cell wall, to protect them and stop bacteria drying out.

SIEMENS

KS3

## Did you know?

A single bacteria consists of just one cell, called a single-celled or unicellular organism. Even though it is just a single cell, it can carry out all seven life processes.

## Can you name all seven life processes?

1.

2.

3.

4.

5.

6.

7.

SIEMENS

KS3

## Bonus activity:

Now that you've done that, can you match all seven life processes to their correct description?

| Process | Description |
|---|---|
| | Taking in and using food. |
| | All living things grow. |
| | Detecting changes in the surroundings. |
| | Getting rid of waste. |
| | Making more living things of the same type. |
| | Getting energy from food. |
| | All living things move, even plants. |

SIEMENS

KS3

SIEMENS SMART BUILDINGS

# What are viruses?

Viruses are very small particles that can infect animals and plants and make them sick. Unlike bacteria, viruses are not alive because they don't complete all of the seven life processes and they cannot survive on their own. Viruses can, however, exist on surfaces for a certain amount of time. Eventually though, they need a living thing or a host to survive and reproduce. This is why it's so important to keep surfaces clean and sanitised to prevent viruses from spreading.

## Did you know?

**Viruses are 10 to 100 times smaller than the smallest bacteria!**

## What are viruses made from?

Viruses can take all shapes and sizes but they are all made up of a relatively short length of DNA which is surrounded by a protein coat. These are then encased in what is known as an envelope, or the outermost layer, which protects the genetic material inside when the virus is travelling between hosts.

When the virus has infected a suitable host cell or cells, they replicate themselves within the cell thousands of times. They do not divide and reproduce like bacteria, but replicate their DNA and protein coats. These are then assembled into new virus particles which allows them to spread very quickly - often in a matter of hours or days.

## Did you know?

**Viral infections are difficult to treat and are resistant to drugs like antibiotics.**

SIEMENS

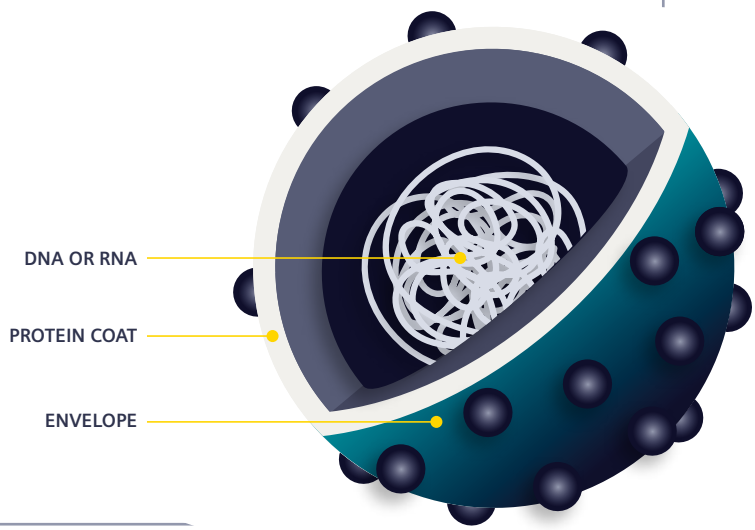
KS3

## Draw a Coronavirus

Below is a simple diagram which shows all the components of a basic viral structure. You may have heard lots of information about the new Coronavirus, Covid-19, but do you know where it got its name from?

It's called a Coronavirus because "corona" means "crown" in Latin. And the virus envelope of this particular viral structure is very similar to a spiky crown. COVID-19 is therefore an abbreviation of Coronavirus Disease 2019 - the year in which the first known case occurred. Knowing what you do now about viruses and their structures, **draw your own interpretation of what you think a Coronavirus might look like under a microscope.**

Share the results with your fellow students after. Did any of you draw similar things or do they look different?



SIEMENS

KS3

## Virus wordsearch

How many common virus types can you find in the below wordsearch? Use the list on the right-hand side to help you.

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

Gastroenteritis

Common Cold

Measles

Conjunctivitis

Meningitis

E-Coli

Coronavirus

Flu

Chickenpox

Pneumonia

SIEMENS

KS3

SIEMENS SMART BUILDINGS

# Controlling the spread of bacteria and viruses

Most bacteria and viruses are spread through the air in sneezes, coughs, or even breaths. They can also spread in sweat, saliva and blood. Some pass from person to person by touching something that is contaminated, like shaking hands with someone who has a cold and then touching your own nose or eating food that a contaminated person has prepared.

Being very small and lightweight, they can float through the air, survive in water, or on hard surfaces like tables and even your own skin.

## Glitter germs activity

Sprinkle a small amount of glitter into your hands. Rub your hands together to spread the glitter evenly. Next, your teacher will give you a number from 1 to 3 and an instruction for your number. This will be the type of method you need to experiment with to remove the glitter from your hands.

Maintaining a safe distance from others, follow your instruction and try your best to clean the glitter off.

Compare results with your fellow students. What do you think worked the best and why?

## Did you know?

**When new types of bacteria and viruses enter our societies, communities sometimes have to take special proactive measures to improve public health and safety.**

## Germ stickers at-home activity

Your teacher will give you some ‘germ’ stickers to use for this activity at home. For half an hour, stick a little germ to everything that you touch. When half an hour is up, look around the room to see how many germs have spread. Take some photos and share them with your fellow students. Are you surprised at the result?

SIEMENS

KS3

## Did you know?

**Handwashing is one of the most effective preventative measures against the spread of bacteria and viruses.**

## Design a COVID-19 poster

Now that you've completed the above, think of some measures that have been introduced to help control the spread of Covid-19 in your school - and in other public spaces too. Design a poster to outline helpful guidance on how you can protect yourself, and others, from COVID-19 and other similar viruses.

**Remember:** posters need to be visually engaging and easy to understand, so make sure yours is eye-catching and clearly explains the key steps of any guidance measures.

SIEMENS

KS3

SIEMENS SMART BUILDINGS

# Public safety and technology

## How can technology help with public health?

With all of the smart technology we have in today's world, it's possible to create safer and healthier indoor environments for people. Those environments might include office buildings, shopping centres, schools and places like airports and hospitals.

It's important to keep public spaces clean and sanitised, but technology can help us further enhance and maintain safety and sanitation in the spaces we share together.

## Did you know?

**It's possible to install special technologies and systems that allow buildings and indoor spaces to think for themselves.**

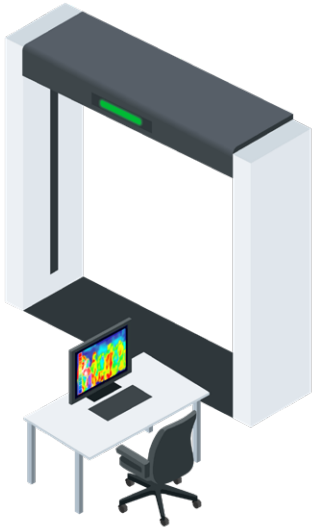
## Smart Buildings

Using different technologies, buildings can measure and monitor conditions within them to help maintain safe indoor environments, and keep the people who use them protected. This might be as simple as turning on the air conditioning in an office on a hot day, to keep people cool. It can also be used to monitor the health of the people using the building, to help control the spread of harmful bacteria or viruses in public spaces.

## What smart technologies already exist?

### Thermal Scanning Technology

This clever technology uses thermal cameras to scan people on their arrival to a building and checks their temperature to make sure they're not ill before entering. What's also useful is that this can be done contactlessly, from 2 metres away. If someone has a high temperature, the system can flag this with acoustic and visual alarms to make them aware - so they can go home to rest, recover and keep everyone else safe too.



SIEMENS

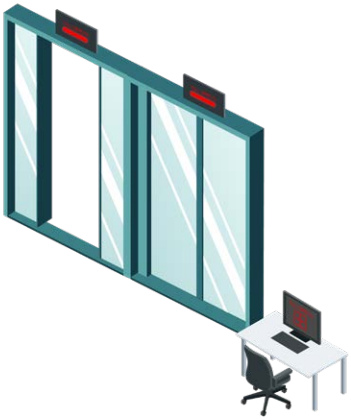
KS3

## Ionisation Technology

This special technology works 24 hours a day, 365 days a year, to purify the air inside buildings and ultimately improve the air quality. It works with existing heating, ventilation and air conditioning units to continuously clean and disinfect the indoor air - helping to reduce and remove the potential for bacteria and viruses to infect people.

Cleverly, the system works by using ions (electrically charged particles) in air systems to break down the molecular structure of viruses, bacteria, pathogens and mould. Ions then react to form hydroxyls (oxygen bonded to hydrogen) to rob the dangerous things of the oxygen they need to survive.

## Security Access Control Systems



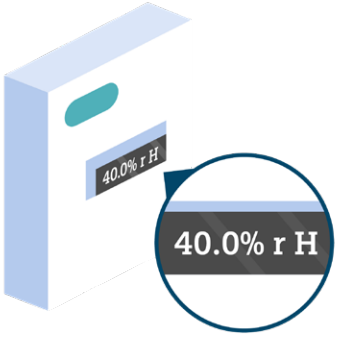
As well as taking people's temperatures, it's important to know how many people are in a building or space at any given time. Used across entry and exit points, these systems can monitor the number of people entering and leaving a space remotely - alongside video surveillance and intruder detection technology.

## UV Light Room Sterilisation Systems/Smart Sensors

These systems can be portable (meaning they can move around) or permanent (so fixed in one place). They can be used for high traffic areas and touchable surfaces, like bathrooms or meeting rooms, that are used by lots of people frequently - and are therefore a high-risk area for the spread of germs.

The UV systems work by using smart sensors throughout buildings, which act by detecting motion and monitoring how long a space was used for and by how many people. This information will be fed back to a central database, which can then tell the UV system it's time to re-sterilize the area in question and help by removing bacteria, mould and potential harmful viruses.

## Relative Humidity Sensors




These clever sensors measure the humidity of a space to help control and adjust the temperature and relative humidity (air pressure and temperature) across a space. Maintaining humidity at a 40-60% level will help to stop the spread of harmful bacteria and viruses.

SIEMENS

KS3

## Did you know?

**The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.**

### Contact Tracking Systems

You may have heard about contact tracking systems in relation to Covid-19, as our very own government has launched a contact tracking app in England and Wales to help monitor the spread of disease. These systems record details about people's movements and will be updated if a person becomes ill, or spends time near a person who is ill. This way it can monitor people's movements, to help track and control the spread of disease and ultimately keep everyone safe. They are also customisable to help preserve people's data and privacy.

### Real-Time Communication Tools

As human beings, we like to be kept up to date with the latest information - especially in times of uncertainty. Communication tools ensure that people using buildings and public spaces feel informed and connected. They can also be used in emergency situations to share information quickly and reliably.

## Design a smart plan for your school

Using your new information about smart technologies, draw a floorplan of your school and think about the key areas you could use different technologies in to improve the health and safety of everyone in the building.

Add labels for the different technologies or draw these in the relevant locations, to show where you'd place them. Discuss your plan with your fellow students and explain why you chose to place certain technologies in specific places. Did any of you have the same ideas?