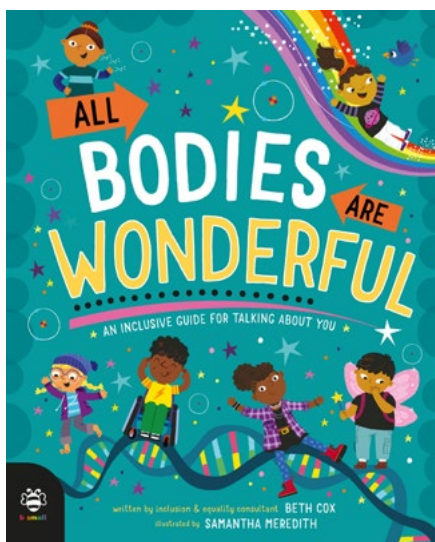


ALL BODIES ARE WONDERFUL

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 2024.



Each activity sheet contains ideas for activities 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.

Working with scientists

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 medic or clinical therapist. A Royal Society Partnership Grant of up to £3,000 could support your school to work with a scientist in this way.



Combatting stereotypes

Teachers may want to watch this short video "Redraw the balance", which highlights how prevalent stereotypes are from a very early age all round the world and how important it is for us to combat them. Scan the QR code to watch the video at [youtube.com/watch?v=uUYwHcwp2sA](https://www.youtube.com/watch?v=uUYwHcwp2sA)

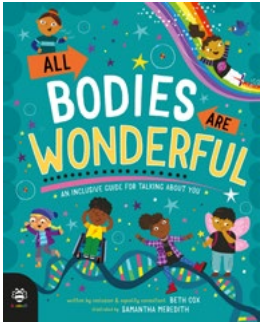


Jumping to conclusions

To help pupils understand what stereotypes are and how prevalent they can be, set them a challenge. Tell them that they are going to have to listen extra carefully to a short story because at the end you are going to ask them to write down the answer to a question about it.

"A man and his son were involved in a car accident and the son was badly injured. He was rushed to hospital and straight into emergency surgery. Fortunately for the boy the famous surgeon Benson-Smythe was in charge. If anyone could save the boy's life Benson-Smythe could. The surgeon strode into the operating room, looked at the boy and gasped "Oh no, that's my son!".

Ask pupils to write the answer to 'How can the boy be the son of both the surgeon and the man in the car? Several will not have considered that the surgeon could be the boy's mother or that his parents might be a gay couple. Reassure pupils that this is a common mistake to make and is because our brains save energy by making assumptions and jumping to conclusions. That is why we need to work extra hard to combat these stereotypes in ourselves and in each other.



ALL BODIES ARE WONDERFUL

Teacher activity sheet (continued)

Bodies are amazing



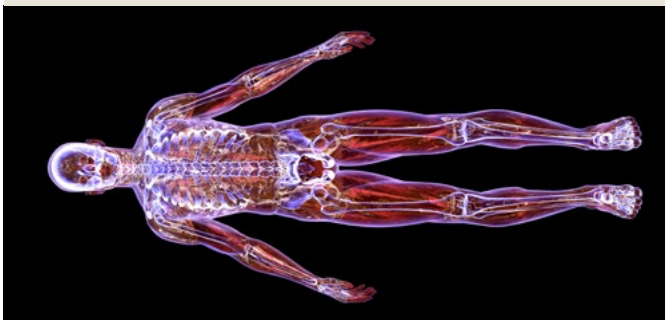
Explain to pupils that you are going to prove to them how amazing they are. Ask them to make stick people with materials such as tin foil or pipe cleaners. Can they make them so that they can stand on two legs? On one leg? On one or two legs while holding a small blob of plasticine in one hand? One or two children will manage some of these challenges by carefully balancing the different elements of their stick person, and many will not. Now ask them to stand up, to stand on one leg and to stand on one leg while holding something in one hand. They might be a bit wobbly, but they will all be able to do these challenges for much longer than most of their stick people. Explain that special organs in their ears are sending messages to their brain which, combined with what they can see, is sending messages to different parts of their body. As a result, they are making tiny adjustments to how they lean and stand to keep them stable.



Taking it further



Explain to pupils that keeping them balanced is just one of the amazing things that their body does. Challenge different groups to research different body systems. For example, the musculoskeletal system, the cardiovascular system and the digestive system. Challenge children to research each of these systems to make a presentation to the rest of the class. Ask them to present in a style as if the facts about these systems have only just been discovered by scientists. This will highlight just how amazing it is that all of these things are happening in our body to keep us healthy without us even knowing.



Career links

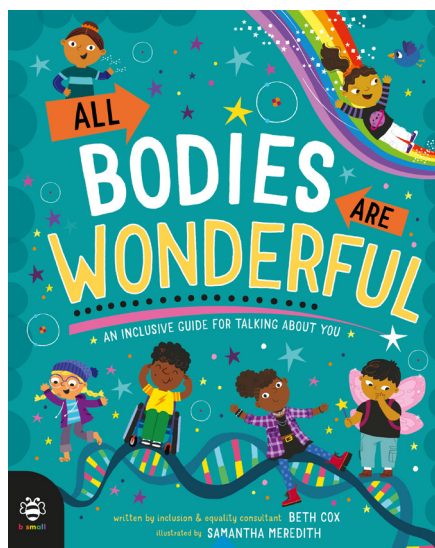


- **Doctors** need to know a lot of science to help them to do what they do. Different doctors specialise in different parts of the body. For example, haematologists work with people who have diseases of the blood and orthopaedic surgeons specialise in bones.
- **Radiologists** are doctors who specialise in using techniques such as x-ray and ultrasound to look inside people's bodies to see what is wrong with them.
- **Radiographers** work closely with radiologists and make some of the specialised images that are then used by radiologists to diagnose disease. For example, if you go into hospital with a suspected broken bone, the radiologist will take an x-ray and the radiologist will then look at it to see if your bone is broken.

ALL BODIES ARE WONDERFUL

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 2024.



“Your body is your completely unique tool for living your life. All bodies are more the same than different.”

Celebrate the wonderful diversity of people's bodies and find out how unique everyone is, whilst at the same time sharing many common features.

Mathematics challenge

Did you know how important it is to have enough people when we are looking for patterns in data about human beings? For example, if you wanted to find out what the most common eye colour is in the town where you live, it would be too difficult to survey every single person so you would need a smaller 'data set'. However, if the data set is too small it could give you the wrong answer. Start by creating a graph that shows the eye colour of the people who sit at your class table, and then create one that shows the eye colour of all the people in your class.



Once you have looked at both graphs, try collecting an even bigger data set by asking more people the same questions; perhaps you could ask everyone in your school. Do you get the same answer to 'Which is the most common eye colour?' with all three graphs? Which one do you think is closer to the one that you would get if you asked everyone in your town?

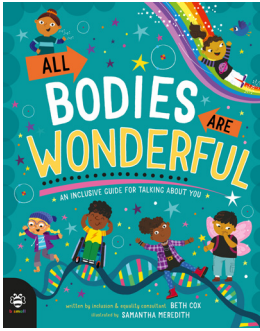
Use the data in the table below to find out how your school compares with the rest of your country and the rest of the world¹. Do you notice anything that surprises you?

Country	Percentage of people with green and yellow eyes	Percentage of people with brown and hazel eyes	Percentage of people with blue eyes
Great Britain	25	32	43
Iceland	14	9	75
Germany	33	27	37
Kazakhstan	12	85	3
Armenia	17	80	3

¹ Based on information from worldpopulationreview.com/country-rankings/eye-color-percentage-by-country.

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ALL BODIES ARE WONDERFUL

Pupil activity sheet (continued)

Family tree



Did you know that we sometimes inherit characteristics from our parents but not always? For example, you might have brown eyes that you inherited from your dad and freckly skin from your mum, or you might look completely different from them both. If you were adopted you might find that you take after your parents in other ways; for example, you might have picked up your dad's habit of scratching his ear when he is thinking. The information passed on from our parents' bodies give us some characteristics, such as blue eyes or red hair. These characteristics can be in a family for many generations without anyone having red hair or blue eyes, until suddenly a baby is born with red hair or blue eyes and everyone is surprised. You could have a chat with your own family about different features that family members share, and ones that are completely unique to that person.



Taking care



Can you imagine if someone gave you a gift that was as amazing as the human body? Even if it wasn't exactly the same as the model that you wanted, or if it was a bit damaged, you would still think that it was very special. You would keep it very safe and do your best to protect it. You would check the 'user's manual' to make sure that you were taking care of your body properly. Well, someone has given you that special gift! You get to use it every day and it does so many things for you all the time. Your life would be impossible without it. Research what you need to do to keep your precious human body safe. What should you do to keep it in tip-top condition? How can you protect it? What fuel should your body have? Make a 'user's manual' so that you, and other people with bodies, can get the most out of them and keep them in good condition for as long as possible.

Scientist profile



Stephen Hawking was a scientist who became famous for the ideas he developed about space, including black holes and gravity. He also worked to help people understand more about science by writing books that non-scientists could understand. What is even more amazing about Stephen Hawking is that for most of his life he needed to use a wheelchair and had a special machine to help him talk. He even needed people to help him to get dressed and to eat. But he never let his disability hold him back and he became one of the greatest scientists of our time. Stephen Hawking died only a few years ago in 2018.



CAN YOU GET RAINBOWS IN SPACE?

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 2024.



Each activity sheet contains ideas for activities 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.

Working with scientists

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 could be more memorable if they were able to collaborate with a scientist such as an optometrist or colour technician. If you work with a scientist in this way you could also consider applying for a Royal Society Partnership Grant of up to £3,000.



Splitting light

There are many ways to make a rainbow, but they all involve bending rays of light. Because the different colours of light within white light have different wavelengths, they bend at slightly different angles which separates them from each other. One way to show this is to use a prism and a torch. In a darkened room place the prism on a sheet of white paper and shine the torch through the prism until a rainbow emerges from the other side. Pupils could also experiment shining a torch through a glass of water.

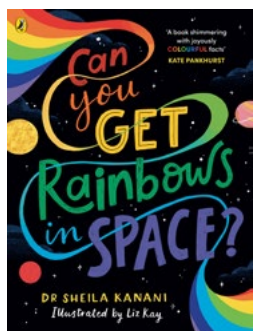
On sunny days the mist of water from a sprayer can also be used. Pupils will need to have their back to the sun as they spray. They are more likely to see a rainbow if the sun is relatively low in the sky.

Ask pupils whether they are now able to explain why we see rainbows on days when it is sunny and raining at the same time. Whereabouts in the sky are they most likely to see a rainbow?



Take care

- Remind pupils that they should never look directly at the sun as this could damage their eyes.



CAN YOU GET RAINBOWS IN SPACE?

Teacher activity sheet (continued)

Eat the rainbow



We all know that we should eat our greens but do your pupils also know that they should 'eat the rainbow'? No, this doesn't mean a packet of smarties every day but eating different coloured plants. Different colours are a good indicator of the nutrients that fruit and vegetables have. For example, orange and yellow vegetables like carrots are a good source of carotenoids which the body uses to produce vitamin A, whereas blue and purple vegetables are a good source of anthocyanins which are powerful antioxidants that help to protect our body from damage. Challenge children to find different fruit and vegetables for all the colours of the rainbow. They could make a rainbow fruit skewer or a multicoloured salad.



Do you see what I see?

For a long-time people, including scientists, have wondered if what we see is the same as what other people see. For example, when you see blue, do you see it the same way that your friend sees it? Several years ago, this became a hot topic for debate when a photograph of a dress was seen by some people as blue and black and by others as white and gold. Scientists explained that one reason for this confusion was that the original photograph had been taken in poor light, so the picture did not give enough information to the brain to be able to see for sure what colour it was. Consequently, the brain filled in the gaps in information by guessing. The colours seen by each viewer depended upon the guess that their brain had made. Show your pupils the picture and see what they think.



Career links

- **Colour technologists** work in many industries to ensure that colours are reproduced accurately, that they don't fade too quickly and that they can be produced in large enough amounts. Among other things, they might be involved in the manufacture of dyes and pigments for things like clothes, paints, cosmetics or car bodies.
- **Climatologists and meteorologists** study weather. Meteorologists focus on short term changes and forecast the weather a few days ahead. Climatologists are interested in longer term changes and forecast what might happen over thousands of years as a result of climate change.
- **Optometrists** test people's eyes and, if necessary, prescribe glasses to help them to see more clearly. They can also diagnose some eye conditions that, if left untreated, can lead to blindness.



CAN YOU GET RAINBOWS IN SPACE

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 2024.



In this book you will learn about light and colour and why we see things the way we do.

“Rainbows are displays of science and nature at their best, and they have different symbolism in religions and cultures around the world.”

Investigating shades of green

In the book we discover that the human eye can see more shades of green than any other colour. This is because there are so many different shades of green in the natural world. To show this for yourself fold a paper in half and half again until when you open it out, there are 16 rectangles. Now, mix blue and yellow paint to make as many different shades of green as you can. You might add tiny drops of other colours too but be careful or you will end up with a muddy brown colour instead of green.

Once the paint has dried take it outside to a place where plants grow and see how many of the different shades of green you can find. Don't forget to look at all the plants including the trees, the grass and the moss as well as shrubs and flowering plants. You may be surprised at just how many of the different shades you can find.



Mathematics challenge

Data loggers are instruments for measuring temperature, noise levels and light. If you have data loggers in school you could use these, otherwise see if your teacher is able to download a data logging app onto your school iPad or other technology. Start by exploring the technology. This is something that you could explore at home too if there is a smartphone that you can use. Perhaps you could measure the light levels in different rooms of your house to see if they are the same. You could also compare the same rooms at day and at night.

Making bubbles

Have you ever noticed rainbows on the soapy surface of a bubble? This is because the curved surface of the bubble bends the light as it shines through, and this splits the light into all the separate colours. You can try this for yourself by making your own bubble mixture. Scan the QR code to investigate the ingredients needed to make the best bubbles at york.ac.uk/ciec/resources/primary/industry-at-home/#the-best-bubble-7+





CAN YOU GET RAINBOWS IN SPACE

Pupil activity sheet (continued)

Chromatography

Did you know that the ink in most coloured felt pens is made up of more than one colour? You will need a cup with 2cm of water in the bottom, a white paper towel cut into strips, a selection of washable felt pens in a bright colour (orange and green work well) and a peg. Make a dot of colour at the end of a strip of paper towel and then suspend the strip so that the tip is in the water and the coloured dot is just above the water line. A good way to do this is to balance a pen or stick across the top of the cup and hold the paper strip in place with the peg. Leave it for ten minutes, when you come back you will see the different colours that have been mixed to make one colour. Try it with different coloured pens; you may be surprised at what you see.



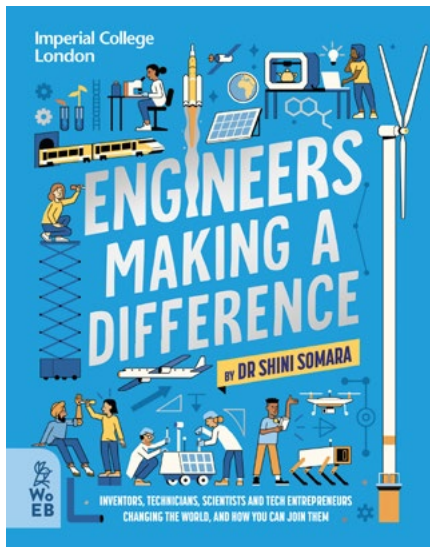
Scientist profile

Dr Sheila Kanani has been interested in space and astronomy since she was 13 years old and remains excited about space and our solar system to this day. When she was working to become a doctor of astrophysics, she studied Saturn using information sent from an unmanned space craft called Cassini. She also discovered that she had a passion for sharing her love of space and the solar system with other people, to help them understand how amazing it is. She thinks it is important to always ask questions because that is how we find things out; if we don't ask questions, we won't find out. She has written several books for children and *Can you get rainbows in space?* is her latest one.

ENGINEERS MAKING A DIFFERENCE

Teacher activity sheet

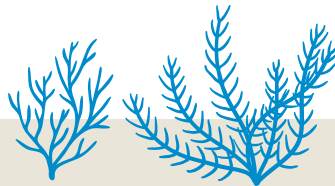
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Working with scientists

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 could be more memorable if they were able to collaborate with engineers, such as a mechanical engineer or an environmental engineer. The Royal Society Partnership Grants supports schools to complete investigative projects with STEM professionals, like engineers, with a grant of up to £3,000.



Sustainable plastics

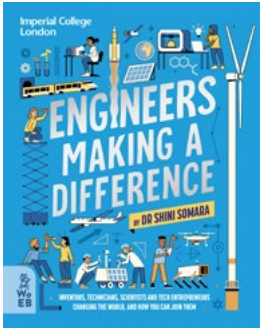
To reduce the amount of single-use plastic polluting the environment, materials design engineer, Pierre Paslier (page 36), is working to create biodegradable plastic made from seaweed. Take your class on their own journey of bioplastic discovery with the Making Plastic from Potato Starch activity, featured in CIEC's Potatoes to Plastics activity pack. Pupils will experience reversible and irreversible changes as they sieve, filter and evaporate their way from waste potato peel to an eco-friendly bioplastic.



Take it further

CIEC's Potatoes to Plastics activity pack features a great collection of card games using the Science Solutions cards. Introduce your pupils to a fascinating range of green solutions which creative scientists and engineers have discovered in their search for waste reduction. Scan the QR code to access all CIEC activities at york.ac.uk/ciec/resources/





ENGINEERS MAKING A DIFFERENCE

Teacher activity sheet (continued)

Sustainable fuels

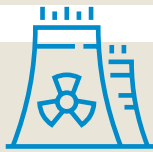
As electrical devices become an ever-increasing presence in our lives, our need to generate electricity to power them continues to grow. It can take lots of fuel to generate electricity and professor of environmental engineering, Dr Lynsey Melville (p38), is working on a solution that uses biomass, instead of fossil fuels. Biomass comes from the remains and waste of living things and her work helps reduce the amount of carbon dioxide which would otherwise be released into the atmosphere.

To learn about sustainable fuel sources, ask your pupils to carry out CIEC's Which Plant Material? investigation. They will find out about plant-based fuels and real-world solutions to transferring energy for heating and generating electricity, in ways which are better for our environment.

If you would like to delve further into the topic of sustainable fuels, explore the Sustainable Fuels sequence of activities in CIEC's investigation pack: Sustainable Stories and Solutions for our Planet.

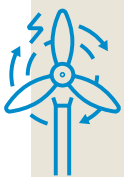


Sustainable energy



Anna Gates (page 33), a civil engineering apprentice, is working as part of the team preparing for a new nuclear power station to open in 2027. Nuclear power generates electricity without the need for fossil fuels to be burned, meaning fewer carbon emissions.

There are several other methods of electricity generation which are better for our environment than coal burning power plants. These include solar, hydro, and wind power. CIEC's Wonderful



Wind activity is the perfect challenge to get your pupils thinking like engineers as they build and test their own windmill to lift a bucket in response to a request to help solve problems in a developing country.

Did you know...? On 30th September 2024, the UK closed its last coal-fired power plant, Ratcliffe-on-Soar, ending its 142-year reliance on the fossil fuel. We are the first G7 member state to achieve this goal!

Career links

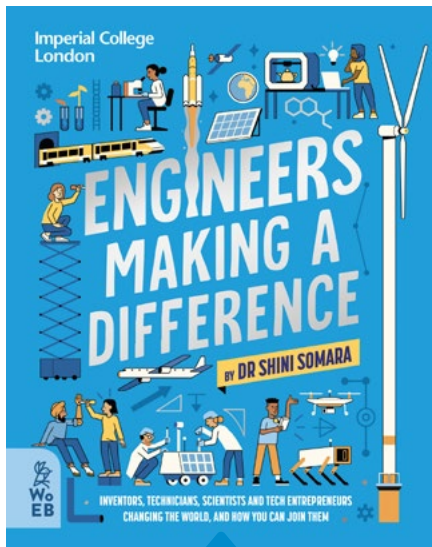


- **Mechanical engineers** design and build machines and tools that make our lives easier. They work with moving parts, engines, and things that help other machines run smoothly. Their job is to make sure everything works well together, like a puzzle, so that machines can do things like lift, turn, or move.
- **Materials design engineers** study the properties of different types of materials to create new things or improve existing things. If you want to build something strong, or flexible, or light, a materials design engineer will figure out the best materials to use and how to combine them to make the best object for a specific job.
- **Environmental engineers** help protect the Earth by finding ways to solve problems like pollution, dirty water, and air that's hard to breathe. Imagine if we didn't have clean water to drink, or if the air was full of harmful gases; environmental engineers work to stop that from happening. They help protect nature, animals, and people by keeping the environment safe and clean.

ENGINEERS MAKING A DIFFERENCE

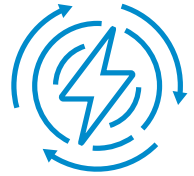
Pupil activity sheet

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 2024.



“I believe engineers are undercover superheroes, who save lives in many ways, by building safe bridges, planes, medical equipment and much much more.”

Do you like solving problems? Do you enjoy science and maths? Do you want to help protect our planet for the future? This is the book for you! Engineers are the superheroes of today's world. They use their problem-solving skills to tackle the biggest challenges we have, generating electricity without burning fossil fuels, designing artificial limbs, ending food shortages and designing technology to explore the surface of Mars. Turn the pages and meet 46 incredible engineers ranging from apprentices and lab technicians, to university professors. Hear about the problems they are solving and why they love their jobs.



Mathematics challenge

How many grams or kilograms of waste do you think you produce in a day? How about a month, or even a whole year?

It soon adds up!

Find out how much waste your class produces in a day, and use this information to calculate how much waste you create in a whole year. Can you calculate how much your whole school might generate in the same time period?

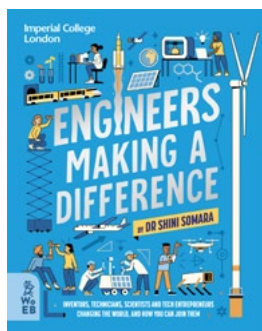
	1 day	1 week	Half term	Term	School year
My class					
My year group / key stage					
Whole school					



Question for discussion:

How can we reduce the amount of waste we produce?





ENGINEERS MAKING A DIFFERENCE

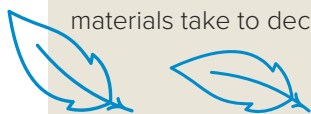
Pupil activity sheet (continued)

Packaging problems

Dr Elena Dieckmann (page 109) has a creative engineering solution to the growing need for more sustainable forms of parcel packaging... chicken feathers! People are ordering more goods to their homes than ever before and packaging materials are in high demand. It's great to see an increasing number of options which help towards climate recovery.

Collect a selection of packaging material samples such as cardboard, shredded paper, packing peanuts, bubble wrap and biodegradable plastic. Ask an adult to help you bury your samples in some soil. This could be a few cm deep in a garden or planter, or in a container or tray filled with soil. Return to your samples at regular intervals (weekly or monthly) to make observations.

Which samples do you predict will decompose quicker than others? You might present your results in a bar graph, a photo diary, or a timeline to show how long the different materials take to decompose.



Washing woes

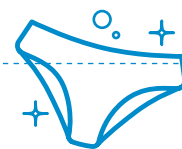
Navjot Sawhney (page 17), aerospace engineer turned washing machine superhero, used his mum's salad spinner as inspiration for his low-cost manual washing machine, designed to improve the health and wellbeing of people living in disadvantaged communities around the world.

How many items of clothing do you own? Do you have different clothes for different purposes, like a PE kit, your school uniform, and clothes for special occasions like parties? All these clothes need to be washed when they are dirty. You probably use an automatic washing machine at home or in a launderette to make the job of washing clothes easier. The powders, liquids, capsules and sheets we use in washing machines help to remove the dirt from our clothes.

Are you ready for your own washing challenge? Washing products that remove stains effectively and wash clothes well at low temperatures are better for the environment than those needing high temperatures. Put different washing products to the test with the *Which washing product?* activity from CIEC's *INDUSTRY AT HOME* collection. Scan the QR code to access york.ac.uk/ciec/resources/primary/industry-at-home/#which-washing-product?-7+

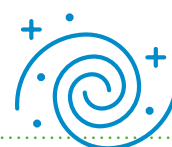


Investigate which washing product is the best at removing stains from fabric.



Scientist profile

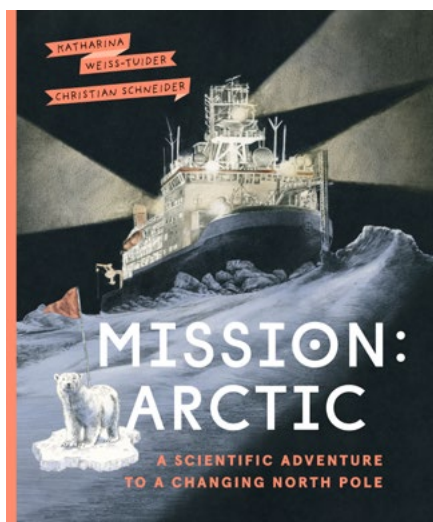
Dr Shini Somara is a mechanical engineer, science communicator, and TV presenter who loves to explain science in fun and easy ways. She has worked on many different projects, sharing how science and technology shape our world. You might see her on TV or online, talking about robots, space, or how things work. She's passionate about helping young people get excited about science, engineering, and learning how things are made. Through her shows and videos, she makes tricky ideas easier to understand so you can discover the wonderful world of science.



MISSION: ARCTIC

Teacher activity sheet

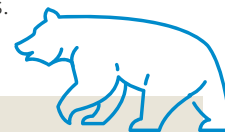
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Working with scientists

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 could be more memorable if they were able to collaborate with scientists. In addition to polar scientists, also consider those working in other extreme environments like offshore platforms or specialising in the science of extreme climates like deserts, rainforests, or mountains. The Royal Society Partnership Grants could support your school with up to £3,000 to work with a STEM professional, such as those working in extreme environments.



Black ice

Crisp white ice reflects more of the Sun's rays than darker surfaces, meaning that heat from the Sun bounces straight back into space rather than heating the Earth up more. Ships passing through Arctic waters burn fuel oil and emit huge amounts of carbon dioxide as well as soot which settles on top of the ice, leaving a discoloured layer. As this layer is much darker than the natural white ice, it absorbs the Sun's heat instead of reflecting it.

To help pupils understand the impact pollution can have on the ability of Arctic ice to stave off global warming, ask your class to set up an investigation to compare the melting speeds of clean 'unpolluted' ice versus dirty 'polluted' ice. Ice cubes can be covered in soil or black paint to represent the soot.

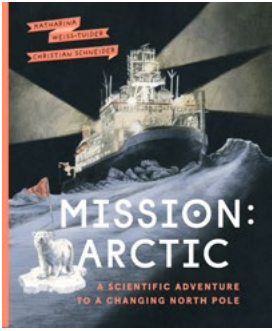


Rise up

Ocean levels are rising due to melting ice, but sea ice is surprisingly not the main culprit. Make some ice balloons by freezing balloons filled with water for at least two days, then remove the outer rubber layer.

Before placing the ice balloons in a bowl of water, ask pupils to predict what will happen to the ice balloons and to the water level. Did they expect the ice balloons to float? Were they surprised when the water level rose? Were they surprised by the cracking sounds? They can discuss with each other what the reasons might be for what they see and hear.

Now ask pupils to predict what will happen to the ice balloons if they are left for 10 minutes, an hour, two hours, etc. Will they melt quickly/slowly? What will happen to the water level? Pupils will be surprised to find that the water level does not rise as the ice balloons melt. Find out more about this interesting phenomenon on page 60 of the book.



MISSION: ARCTIC

Teacher activity sheet (continued)

Protective layers



Arctic temperatures are regularly below freezing point, so the Polarstern team need to dress appropriately to protect themselves from the extreme cold. Invite your pupils to investigate how layering, using insulating materials, can help maintain safe body temperatures.

Provide groups with a paper cup on which they can draw a Polarstern scientist. Provide different materials which pupils can choose from to wrap their 'scientist'. Different types of paper and card, plus fabrics, bubble wrap, kitchen foil and cling film are good options.

Before the cups are fully sealed, fill them three-quarters full of body temperature water (approx. 37°C), then place in the freezer. Use thermometers or data loggers to take temperature readings at regular intervals, to see which material, or combination of materials, provides the best insulation.

Top tip: 30-minute intervals work well.

Groups compete to see which 'scientist' will last the longest before freezing.

Pages 32 – 33 of the book show how Arctic scientists' clothing has changed from the early days of polar exploration in 1894 to the modern day.



Career links



- **Atmospheric scientists** study the Earth's atmosphere (the layers of gases that surround our planet). They collect and analyse huge sets of data to find out about weather patterns, climate systems, air quality, and how human activities affect the atmosphere. Their work also involves understanding how the atmosphere interacts with other things on Earth like oceans and ecosystems.
- **Climate forecasters** learn about long term weather patterns and make predictions about future climate trends. They try to improve our understanding of the Earth's climate and how it might change over time. To achieve this, they use specialist equipment to collect data which they will analyse carefully to look for patterns. Their work can help us to prepare for or limit the negative effects of climate changes in the future.

In addition to the scientists on board the Polarstern, there are some job roles you perhaps did not think about such as:

- **photographer** and **cinematographer**
 - capturing a visual record of the expedition for future generations to see,
- **bear guard** – always on guard on the ice to make sure the polar bears don't get too close,
- **graduate student** – one of the youngest team members building their career as a scientist and researcher.

MISSION: ARCTIC

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 2024.



The Arctic is changing fast. The once-frozen landscape is melting before our eyes, and the effects can be felt around the world. But the Arctic is also the region we know the least about. Thick ice, extreme cold, and total darkness have prevented scientists from uncovering its secrets.

Until now. Written by Katharina Weiss-Tuider and illustrated by Christian Schneider.



“Humans have been on the Moon and in the deepest depths of the oceans. People are living on a space station, and our space probes have gone past the limits of our solar system. We have already explored and discovered so much. But the Central Arctic is still a big mystery to us.”

Ice balloons

Arctic scientists need to know as much as possible about the ice which surrounds them. Fill some balloons with water and add food colouring for added fun. Place your balloons into a freezer for two days. Once frozen, remove the outer rubber layer and you'll be left with ice balloons. Observe your ice balloons to see what happens to them.

What do they look like? What shape are they? Hold them with gloves on, how do they feel? Are they heavy or light? Do they all look the same? What will happen if you leave them in different environments? You could leave them indoors (in a container) or outdoors, in the sun or shade. Observe one on a cold day and others on warmer days. Can you think of any questions you would like to investigate?

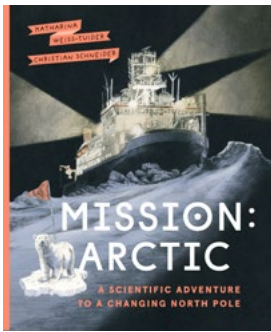


Seeking skilled scientist

Mission Arctic is recruiting! The mission leader needs a team of highly skilled scientists who can work together to carry out the challenges which lie ahead. On page 30, we meet the Polarstern team, a huge array of people with a wide range of different skills and abilities.

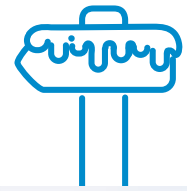
Apply for a job in the team. Write a short letter to mission leader, Markus Rex, to tell him about your super scientist skills. Do you ask good questions, make great predictions, and set up fair tests? Can you make careful observations and measurements then record your data to present it clearly in graphs or tables? How do you interpret results and evaluate your methods?

Think about other skills that will make you a valuable part of the team. Are you a good communicator? Do you resolve disagreements politely? Can you share your ideas with others and listen to team mates? Do you have a good sense of humour?



MISSION: ARCTIC

Pupil activity sheet (continued)



Melting moments

Make ice shapes by filling a variety of different containers with water and leaving them to freeze. The more shapes you have the better! Here are some you could try:

- Sphere (round balloon)
- Cube (square snack container)
- Cuboid (rectangular food container)
- Cylinder (plastic cup)
- Long balloon
- Disposable glove
- Ice cube trays in various shapes and sizes

Which shape melts the fastest? Design and carry out a comparative test, perhaps using the same amount of water in each container. Observe the shapes melting. Does the shape make any difference to how quickly the ice melted?

Melting moments



Protecting the climate is a huge task; you might find yourself wondering what you can possibly achieve on your own. If we all start with a few small changes, then scale up our efforts when we feel ready for the next challenge, our collective actions can make a huge difference.

Create a climate pledge; you could involve your family or your class. Start with 5-10 actions you will take. These could be as simple as riding your bike to school rather than travelling by car, switching unused devices off completely overnight rather than leaving them on standby, or making sure you remember to take your own bags to the supermarket for your weekly shop.



Scientist profile

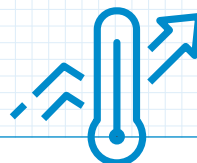
Meet Dr Markus Rex, a polar and atmospheric scientist, and the expedition leader on board the Polarstern research icebreaker.

Markus has been travelling to extreme polar regions such as Svalbard since he was a student researcher in the 1990s to carry out scientific research into the effects of climate change. What happens in the Arctic has a direct impact on the weather and climate in the rest of the world so his discoveries are extremely important.

The unprecedented Polarstern expedition (September 2019 – October 2020) was the largest polar expedition in history. Markus led a team of almost five hundred people from all over the world as they observed and investigated the many small pieces of the Arctic climate system jigsaw puzzle to better understand how all the parts of the world's climate system are connected.

Mathematics challenge

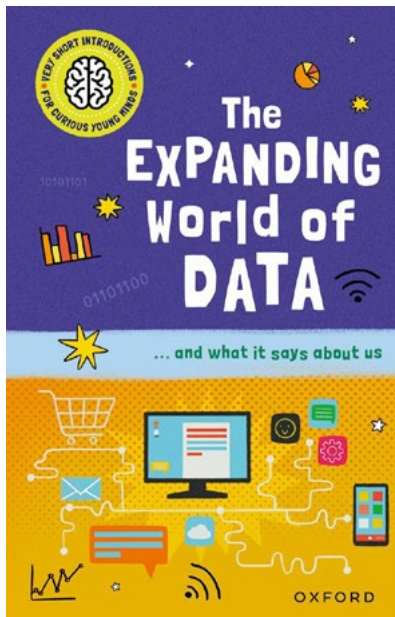
There is more of the gas carbon dioxide in our atmosphere today than ever before. For most of the world's history this has been at safe levels and carbon dioxide is in fact very important to have in our atmosphere. However, we now have high levels that are causing global temperatures to rise, which in turn causes our oceans and seas to get warmer. How might this affect the Arctic ice? Place some ice cubes in water at different temperatures and make careful observations. You could use a thermometer or a data-logger to measure the water temperatures and find out how different temperatures affect the ice cubes.



THE EXPANDING WORLD OF DATA

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 2024.



Each activity sheet contains ideas for activities 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.

Working with scientists

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 data scientist or climate scientist. If you work with a scientist in this way you could also consider applying for a Royal Society Partnership Grant of up to £3,000.

Ahead of the curve

Bell curves emerge when large data sets are plotted on a line graph and reveal how most results in investigations are close to the average value and only a few are really low or really high. Examples include the heights and weights of adults, reaction speeds, and people's shoe sizes.

Place a starting point on the floor and have pupils jump as far as they can from a standing position. Some may jump an impressive distance, others may only jump a short way. Most pupils will jump an 'average' distance.

Ask pupils to collect the data showing the number of people and the distance they jumped to the nearest cm, then turn this data into a line graph. Joining up the data points on the line graph should produce a bell curve. Pupils could extend their

Raising the bar

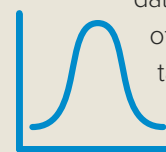
Data can be difficult to understand when there are just lots of numbers. In 1786, data hero William Playfair (pages 44 – 45) wanted to find a visual way of making lots of complex information easy for his colleagues to compare. He became the inventor of the very first bar chart.

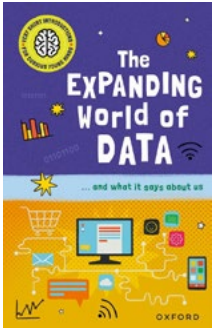


And in 1854, John Snow (pages 40 – 41), a doctor treating patients for the deadly stomach disease cholera, turned data into a map to show that the outbreak was linked to a contaminated drinking fountain. His map convinced the council to turn off one particular water pump and the disease went away. Doctors today use similar methods of presenting data when serious diseases start to spread.

Ask your pupils to create their own bar chart. They could compare how tall plants grow in different conditions, the numbers of animals found in different habitats, the warmest and coldest temperatures for each day this week. You could provide a ready-made data set, such as temperatures from the Met Office weather app. Remind pupils to label the X and Y axis and decide on the minimum and maximum numbers for their scale. Every good bar chart needs a title too, so people can understand what the bars on the bar chart represent.

data range by inviting other classes to take part in the challenge.





THE EXPANDING WORLD OF DATA

Teacher activity sheet (continued)



Weather station

Kate Marvel (pages 62 – 63), an American climate scientist, collected data about soil, clouds and tree growth to track climate changes in the past, as a way of predicting changes which may happen in the future. Ask pupils to discuss how collecting data over time can help predict what future data might be.

Please note: pupils will not be able to collect climate data as this is collected over tens, hundreds, and even thousands of years. To experience a simplified version of this data collection process, challenge your class to set up their own weather monitoring station.

Basic equipment, such as a thermometer or data logger can be used to measure daily temperatures. Other weather conditions can also be measured. Search online for instructions on how to make the following:



ANEMOMETER

Wind speed

WIND VANE

Wind direction

RAIN GAUGE

Rain fall

Pupils can set up more than one weather station to compare locations. After a period of monitoring (a week or a month would work well), pupils can turn their data into an informative poster to share what they found out. They could include bar graphs and line graphs, and design weather symbols. You can challenge pupils to analyse any patterns in their data and predict next week's weather.



Career links

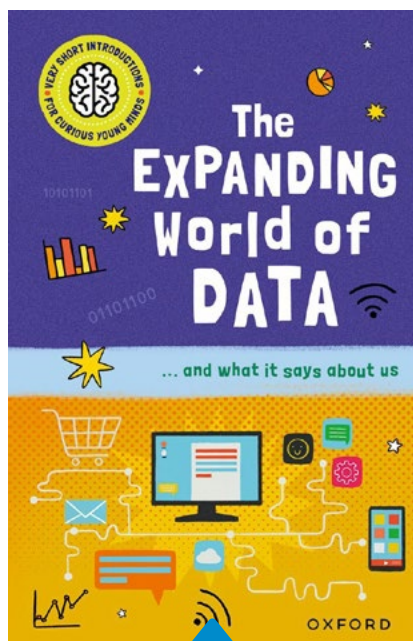


- **Data scientists** use numbers and information to solve problems. Imagine a huge box of LEGO™ bricks containing all different colours and shapes. A data scientist's job is to look in the box and find patterns, perhaps how many bricks of different colours there are, or which shape is the most common. Then they use that information to identify patterns, answer important questions, or make decisions.
- **Climate scientists** are like detectives for the Earth. They study how the climate works all over the world, looking at things like temperatures, rain fall, and wind speeds, to figure out how Earth's climate is changing. They use tools like satellites in space, computer models, and special machines to collect large amounts of data over many years to learn why Earth is getting hotter, what happens when glaciers melt, or why storms are getting stronger.
- **Bioinformaticians** combine biology, computer science and information technology to analyse data about plants and animals. They work closely with medical professionals, and use computer programs, to make sense of large sets of data. They can help with developing new medicines and treatments for people with complex diseases.

THE EXPANDING WORLD OF DATA

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 2024.



“Data allows us to answer the questions we have about the world.”

Data is information that tells us something about the world, like numbers, words, pictures or measurements. It is an integral part of our lives. It helps us unlock hidden mysteries and predict the future. Data can even help us to make the planet a better place. Uncover the world of data through encounters with data heroes and learn how to speak like a data scientist. This is the perfect book to encourage curious minds to learn about data, what it is, and what it does.

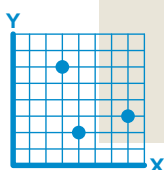
Coordinated habitats

Lying in bed watching a fly buzz around the ceiling, Rene Descartes, a French philosopher, scientist and mathematician in the 1600s, invented coordinates. Imagining a grid of horizontal and vertical lines, Descartes could describe the movement of the fly by identifying different points on the ceiling measured along the numbered lines (the axes).



For this activity, you will need a map of your school grounds, a local park, or nature reserve. You can draw your own or use Google Maps to find and print one. Identify the habitats of all the different plants and creatures which live there. Add an X axis (horizontal) and a Y axis (vertical).

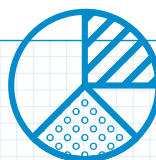
You can use the axes to describe the position of the different living things. Eg mayfly larvae = (5,2). If you're feeling like an extra challenge, you could observe how animals move through the habitat and use coordinates to describe their chosen paths. You could quiz a friend on where they will find different animals in the habitats you have included on your map, asking them to provide the coordinates.



Maths challenge: the lady with the pie chart

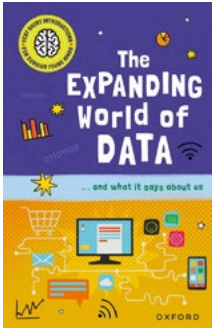
On pages 42 – 43, we learn that in 1854, celebrated nurse Florence Nightingale presented data in diagrams to prove to doctors that wounded Crimean War soldiers were dying from diseases caused by poor hygiene in hospitals; far more than were dying directly from war wounds. Florence called these rose diagrams but today they are better known as pie charts.

Here's some sample data for Florence's records. Can you turn this into a pie chart?



Soldier deaths – January 1854

Cholera	100
Typhoid	50
Crimean fever	200
War wounds	50



THE EXPANDING WORLD OF DATA

Pupil activity sheet (continued)

Citizen science

Scientists often need lots of data to find answers to their questions. When they need more data than they can collect alone, they sometimes ask for help from the public to collect data or make observations for them. It's like being part of a great big science team that helps to make new discoveries.

Search online to find citizen science projects like The Bulb Project, the Big Butterfly Count, or the Big Schools' Birdwatch you can take part in to help scientists discover more about nature, animals, the environment, space and more!



Scientist profile

Meet Dr Bran Knowles! She is a senior lecturer (teacher) in the Data Science Institute at Lancaster University. As a researcher, Bran likes to design ways to find out how people think, feel, and behave.

On Bran's journey to earning her 'doctor' title in Digital Innovation at university, she studied:

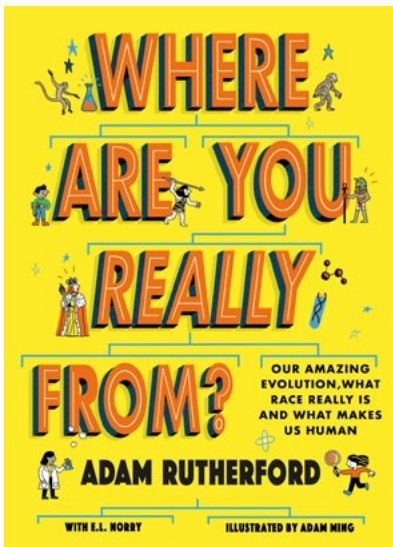
- **Psychology**
The study of the mind and behaviour
- **Sociology**
The study of humans and how they interact
- **Anthropology**
The study of human history, culture, and society
- **Design**
The study of using creativity to solve problems

Bran's research has a big focus on trust in how people's personal data is handled by those collecting it. She uses her knowledge of how people come to trust each other in the real world to help design data systems that people will trust.

WHERE ARE YOU REALLY FROM?

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 2024.



Each activity sheet contains ideas for activities 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.

Working with scientists

These investigations can be done as standalone activities or carried out as an in-depth sequence to develop pupils' disciplinary and substantive knowledge. Collaborating with a scientist such as an evolutionary biologist or museum curator, could be supported by a Royal Society Partnership Grant of up to £3000, making the pupils' deeper learning and science capital development more memorable.

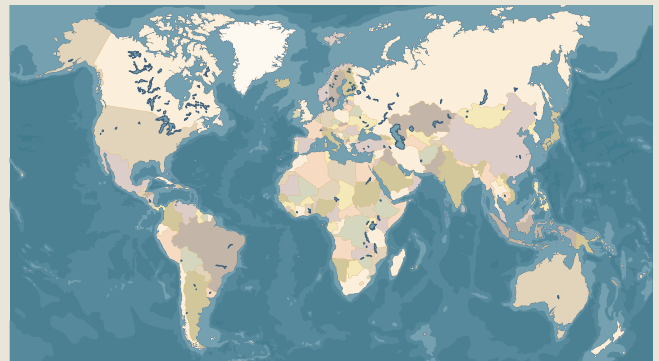
Where are we really from?

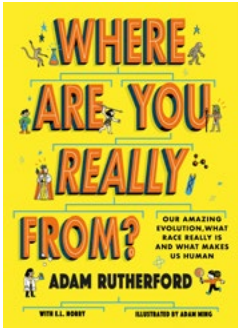
Before carrying out this activity remind pupils that everyone in the UK originated from somewhere else! Our ancestors include Vikings, Romans and Anglo-Saxons and people have been migrating to (and emigrating from) here ever since. This activity provides an opportunity to explain to children that however recently or long ago families arrived in this country, they all belong here and this is their home.

Using a large map of the world and small stickers or pins, start by showing pupils where Africa is. Explain that this is where humans evolved, and if you go back enough generations this is where we all come from. Tell pupils that everyone is going to get a chance to put a sticker on the map on the place where they know that their family originates from. Pupils are likely to need to discuss with their families where to put their pin. It may therefore be useful to send a letter home to parents, to explain that the aim of this activity is to celebrate diversity.

Subsequent discussions may reveal that some children have family roots all in the same place, whilst others will have family members from many different parts of the globe and will need several stickers!

NB This activity is the basis for some of the activities on the pupil sheet. It has been included in the teacher sheet to ensure a sensitive approach to the subject matter.





WHERE ARE YOU REALLY FROM?

Teacher activity sheet (continued)

Human evolution



HOMO NEANDERTHALIS

HOMO SAPIENS

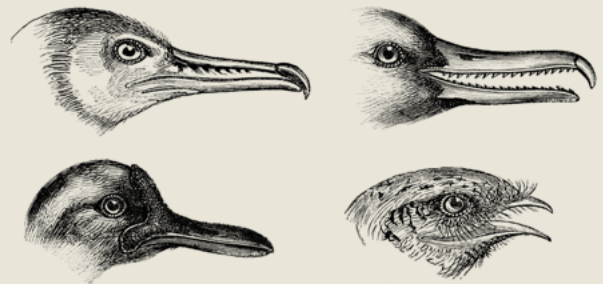
Pupils might not realise that Homo sapiens are not the only humans to have lived on Earth. There have been other human species, including our closest relative Homo neanderthalensis. Neanderthals lived successfully for thousands of years until they became extinct about 40,000 years ago. You can find out more and find pictures to share with your class on the Natural History Museum website. One reason that modern humans might have survived when Neanderthals became extinct, is that we were better adapted to climate changes that happened at that time. The short Natural History Museum video, *Skeletons reveal their secrets*, shows human remains from much more recent times as it looks at skulls excavated from London cemeteries over the last couple of hundred years and the information that they give scientists about the people they came from.



Scan the QR code to watch the video at:
nhm.ac.uk/discover/skeletons-reveal-their-secrets.html

Survival of the fittest

In the book, we learn that animals are more likely to survive and have young if they are well adapted to the place where they live. This activity shows pupils how the shapes of birds' beaks can help them to survive in some environments. To represent the beaks each group of children will need a spoon, easy grip tweezers, a straw, a skewer and a peg. To represent the food, they will need a small pot of rubber bands, marbles, small pasta shapes, some water in the bottom of a small bottle, small marshmallows and some dried peas. Give each group 30 seconds to try and collect as much 'food' as they can using the different 'beaks'. Ask them which beak was better for which food? Was there any food that was easier for all beaks? Was there any type of beak that was not very good at getting food? Now ask them to consider what would happen if a certain type of food was missing. Help them to realise that the bird with a straw beak might go extinct if the food represented by the liquid in a cup was not available.



Career links

- **Anthropologists** study people and everything about them including their societies, their behaviour, culture and language. You can read more about them on page 106 of the book.
- **Evolutionary biologists** study how animals have changed over many generations and evolved to become the modern animals that we know today.

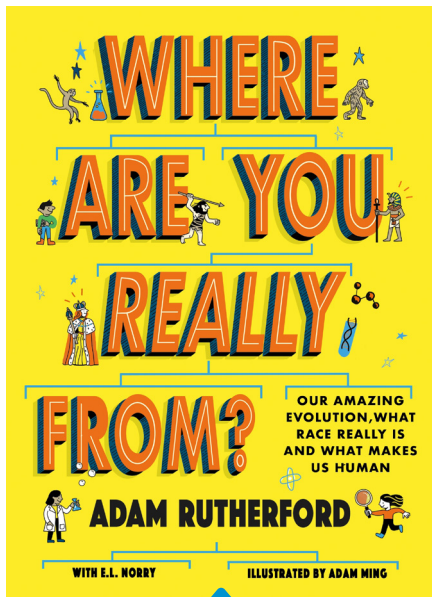
- **Natural history museum curators** look after the samples in a natural history museum. This doesn't just include the exhibits that are on show but collections behind the scenes which need to be carefully looked after and catalogued. Sometimes visiting scientists will need to come and look at objects in the collection to help them with their work.



WHERE ARE YOU REALLY FROM?

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 2024.



“You are part of the greatest story ever told. An epic 4-billion-year tale of life on Earth, and you carry the story of every single one of your ancestors ... You are a walking history book!”

Prepare to be amazed as you find out how you came to be the person you are.

Mathematics challenge

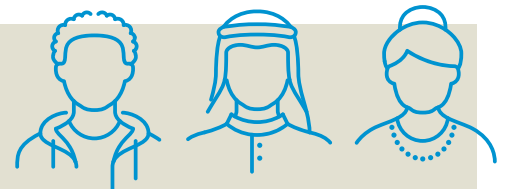
Using information about the family origins of different people in your class, make a graph showing how many are from each place. Before starting your graph, you will need to think carefully about how to make the data manageable by deciding which locations to include.

For example, if lots of people in your class are from the UK, you may want to split the UK into different regions or countries. Alternatively, if most people are from other parts of the world you might want to count everyone in the UK together so that you don't have lots of sections of your chart with just one person in them. If you decide to make a bar chart you are going to have to decide how many people each square will represent.

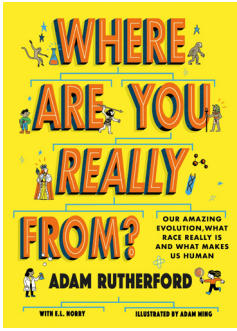
If you make a pie chart, you will need to work out what fraction of your class come from each place and then find the same fraction of 360 to see how much of the circle is needed for each section.

How are we different?

People in different parts of the world have different languages, cultures, clothes and foods. Even



people who come from different parts of the same country might eat slightly different foods and use different words for the same things. Use secondary research, by using books or the internet recommended by your teacher, parent or carer, to find out about some of the cultural differences in areas of the world where people in your class originate. If the person, or their family, have lived in a different country recently they might be able to tell you things about the food, clothes and culture. Or maybe, that person will be finding out too if their parents have always lived in the area where they are now. Studying these types of differences between groups of people is called ethnography and is a type of research used by anthropologists.



WHERE ARE YOU REALLY FROM?

Pupil activity sheet (continued)

Discussion question



What do you think influences you most to be the person that you are? Is it where you were born or the family that you live with? Or could it be the place where you go to school or is it something else? This is something that scientists think about a lot, and they call the discussion 'nature versus nurture'. Nature means things that we are born with, and nurture means things that we learn from our experiences. Someone who runs fast might have been born with the ability to run fast or they might have learned it because they live in a sporty family that does a lot of running. Or maybe it's a bit of both. What do you think?

One thing that scientists do to investigate how much of who we are is influenced by nature and how much by nurture is to study identical twins, especially those who have been brought up in different families, to see whether they have as many similarities as those who have been brought up in a shared family.



How are we the same?

Working with 3 – 4 others in your class, see how many ways you can find that you are the same. Maybe none of you like getting shouted at, you all like chocolate and you like it when your teacher makes you laugh. Challenge yourselves to see how many things you can find in five minutes that are the same. Compare your lists. Are there any that are not shared by everyone? For example, you might find that not everyone in the class likes chocolate.



How many of these similarities and differences do you think are caused by nature, (that is the characteristics that you were born with) and how many do you think are caused by nurture (that is the world you are growing up in)? For example, maybe you all like chocolate because most humans are born liking sweet things. However, only one of you likes gardening and that is because they go to the allotment with their Grandad every weekend. Maybe there are some things that are the same about all of you because of your shared experience in your class and school.



Scientist profile

Dr Adam Rutherford is a well-known TV and radio presenter who helps people who do not have science backgrounds to understand science. As well as his work in TV and radio he lectures at University College London and writes science books for adults. He uses his scientific understanding to explain to people why some ideas about racism are false. *Where Are You Really From?* is his first book for children.