Summer 2020 *Issue 9*

Why & How?

The Primary Science Teaching Trust Newsletter

Supporting excellent teaching and learning in primary science

Free to access for all

Special issue to support school closures and home learning

A NOTE FROM OUR CEO

First, PSTT would like to extend our deepest sympathy to those who have lost loved ones, directly or indirectly, to the pandemic we are now experiencing and second, we want to thank not just NHS workers but all people who have allowed us to have some sort of normality during this on-going situation.

I would like to extend my thanks to the PSTT Fellows and operations team for their rapid and highly effective switching of activity to increased on-line provision. Many of our stakeholders have told me, directly and indirectly, how valuable this on-line support has been. I would like to thank our Regional and Area Mentors who have been supporting teachers to navigate these current times, in what is being called the 'mitigation phase'. Their expertise, insight and calm reassurance have been appreciated greatly and thanks also to Sue Martin (Fellow and SMT member) who leads them. I thank Peter Sainsbury (Fellow and SMT member) for his expert support for our school cluster programmes and I want to take this opportunity to thank him for kindly agreeing to continue in his role as Cluster Director. I am sure that some of you met Florence Nightingale recently on Facebook (through 'Science at Work') and may have made a density column (via 'Science Fun at Home'). Many thanks are due to Ali Eley (Fellow and SMT member) who has taken on a new role as Outreach Director and has led these initiatives for PSTT during this current situation. The speed at which they have been developed and their quality is remarkable, and we also take this opportunity to thank partners, Science Sparks, Spectrum Drama and St Mary's University, which have made these initiatives possible.

The 'I bet you didn't know' series, taking recent research papers in science and providing articles and supporting materials in an accessible format for primary school teachers and their children, has been very well received by teachers and researchers. We now plan to produce a new article every fortnight and I commend to you a series associated with viruses and staying healthy, as well as upcoming articles on a wide range of topics such as climate. Well done Dr. Alison Trew (Fellow) who leads this project and to the small group of Fellows with PhDs in science who have made this project possible.

Whenever the lock-down in the UK (and elsewhere) ends, it is not the end of the pandemic, sadly. Scientists are playing a key role in guiding governments on public safety through to developing the much-needed vaccine. I know that primary schools in the UK (and elsewhere) have a monumental task in the so-called 'compensation phase'. This compensation phase may last for years as we adjust to social distancing in schools and understand how to compensate our children for time lost. I thank Dr. Sophie Franklin (SMT member) for taking on a new role as Research Director during this situation. It is essential that we analyse data from our current and past programmes in order to understand how to move forward; we are working scientifically.

It is key that science and indeed other subjects are not side-lined for greater emphasis in English and Mathematics, although the pressure to focus will be obvious. PSTT is working hard to be able to support teachers in that next phase. We are all in this together and one thread that persists is the generosity of spirit that we have found. Our partner organisations, teachers, businesses etc., like ourselves, are coming together to support the education community. I thank all of you for your help and support.

Best wishes and stay safe

Prof. Dudley Shallcross, CEO PSTT

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WELCOME

The majority of this issue of the newsletter is devoted to supporting teachers with school closures and home learning.

The Primary Science Teaching Trust's termly newsletter Why and How? is for anyone who has an interest in primary science. In this issue, we include our regular News and Key Dates sections, along with a Great Science Share for Schools information page.

Please see the **Collaborator Update** for some insights into what it is like to work towards the Primary Science Quality Mark. We are very grateful to Sacred Heart Catholic Voluntary Academy in Sheffield and Western Primary School in Harrogate for sharing their stories of how PSQM has developed their science subject leaders and how science has changed in their schools.

We would also like to draw your attention to our newest free to download resource in our **Project Update.** Read more about the Big Jurassic Classroom book and resource pack written by PSTT Fellow Carol Sampey, and now available on our website.

Why & How? is the brand name of the Primary Science Teaching Trust
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In the **I bet you didn't know** article, PSTT Fellow Dr. Alison Trew describes the latest research into small magnetic robots, ending with some ideas about how children could model robots in the classroom. In 'The science of hand-washing', an additional I bet you didn't know article specially for this newsletter, PSTT Fellow Dr. Rebecca Ellis describes what is happening when we wash our hands with soap, and she gives suggestions about investigations children could do to understand this better.

Our **climate science** section in this issue is titled 'Connecting with nature and caring for the Earth'. We are delighted that PSTT Fellow and Regional Mentor Ruth Shallcross has been working with the 'Letters to the Earth' team at Harper Collins to create an opportunity for children to write and submit their own letters. Ruth also includes an exciting range of activities to encourage children to engage with nature and to support mental well-being.

Support for School Closures and Home Learning

PSTT has responded to school closures with two new resource initiatives. **Science Fun at Home** is a weekly downloadable two-sided activity sheet with simple suggestions for science investigations that can be done at home. The activities focus on active engagement and on supporting talk between parents/carers and children. **Science at Work** gives children an opportunity to send questions to scientists or people who use science in their jobs, and then 'meet' them in a video. So far the first video of Florence Nightingale has had over five thousand views.

We are very grateful to PSTT Fellows Dr. Paul Tyler and Alex Farrer for producing a free special issue of their extremely popular resource **See Through Science**. This engaging set of images and supporting questions and activity ideas can be used in school or at home.

Our newsletter offers practical support, news and updates about PSTT and our projects and research. We value feedback from our readers so please do continue to keep us posted about what you find most useful and interesting in our newsletter, and please do keep sharing it with anyone else who would like to receive practical classroom support, news and PSTT updates.

Prof. Dudley Shallcross
CEO

Ali Eley
Outreach Director

Dr. Sophie Franklin
Research Director

Sue Martin
Programme Director

Peter Sainsbury
Cluster Director

NEWS

PSTT support for Science Oxford

We are delighted to be supporting Science Oxford with a national roll out of their highly successful flagship project Thinking Doing Talking Science (TDTS).

Developed in partnership with Oxford Brookes University, this national primary science CPD programme was based on an original project funded by the AstraZeneca Science Teaching Trust (the former name of PSTT). It has now been the subject of two large scale evaluations, funded by the Education Endowment Foundation, which have shown that TDTS can make a significant difference to pupil attainment, interest and self-efficacy in science.

Part of a charitable organisation called The Oxford Trust, Science Oxford delivers a unique programme of STEM-based activities, events and clubs for primary and secondary school children, their teachers and families. They also run the Science Oxford Centre, the UK's first integrated indoor-outdoor hands-on science centre for primary and early years. For more information, see **Science Oxford Schools Home Page.**

PSTT Regional Mentor Programme

Our Regional Mentor Programme has been successfully supporting primary science teacher development in targeted locations for almost 3 years. Each Regional Mentor is an outstanding classroom practitioner and award-winning primary science teacher with many years of experience in leading and supporting science teaching. In these current, difficult times, our Regional Mentors have been adapting their provision and working to ensure teachers continue to receive the support they need. Utilising video conferencing in addition to phone and email support, the PSTT has been able to both change our working practices and increase our capacity to support more teachers across the UK.

To find out more about our Regional Mentors, visit the **PSTT website**.

If you need support and would like more details about the PSTT Regional Mentor Programme, please contact the Trust via the PSTT office email address: info@pstt.org.uk

Updates from The Wellcome Trust

Science Education Tracker

Following the initial survey carried out in 2016, this report presents findings about young people's views on science education and careers. The report shows that only 41% of young people in years 7–13 consider an understanding of science to be important to their everyday lives. Relevant reading for all teachers and science educators, the report can be accessed **here**.

The effects of high-quality professional development on teachers and students

This Education Policy Institute report (**accessible here**), commissioned by the Wellcome Trust, reviews the research literature about the effects of professional development. The findings will inform Wellcome's wider research project to examine the benefits of a policy entitling all teachers to thirty-five hours of high-quality professional development every year.

PSTT Fellow Jules Pottle appointed as DK's science teacher in residence

Dorling Kindersley publishers are running a series of science lessons on their Instagram story. PSTT is delighted that Fellow Jules Pottle has been invited to be their resident science teacher. Click **here** to see Jules' first lesson, and if you have an Instagram account, you can click **here** to view all of Jules' lessons.

PSQM during school closures

The PSQM team is working hard to maintain contact and engagement during lock down with nearly 900 schools which are either currently engaged with the programme or should have started in April. Despite all the pressures and uncertainty teachers are facing, they are getting a fantastic response.

- Amazingly all but one of the 185 schools due to submit for their awards at the end of March have completed, and submissions are being reviewed now.
- As well as email support, PSQM is running a programme of weekly online Spotlight events for the 400 schools currently midway through the programme, with over 90 subject leaders attending the first one.
- A Preparing for PSQM programme with regular newsletters and Spotlights on a weekly basis is being offered to the 300 schools that were due to start training this term. These are not replacing the regular CPD, which is delayed until schools reopen, but are additional events to ensure subject leaders make a good start. The first one filled up so quickly that two more had to be put on, with 260 teachers attending in total.

The feedback has been great, and the resilience, resourcefulness and positivity of the teachers is inspiring. There was never a more important time than now to be making sure that science is taught well in primary schools, so that children can make sense of the experience of living through a global pandemic. PSQM is proud to be supporting primary teachers.

Update from SSERC

From 1st April 2020, SSERC has assumed responsibility for the STEM Ambassador Hub covering the East of Scotland. The hub is called SAE@SSERC. It is based within SSERC HQ in Dunfermline, but it will also reach out to all regions within the geographic area that it covers.

More information about SAE@SSERC can be found on their website **www.saesserc.scot**

SSERC will also retain its role as strategic lead for the STEM Ambassador programme in Scotland.

CLIMATE SCIENCE

Connecting with Nature and Caring for the Earth

By Ruth Shallcross,
PSTT College Fellow and Regional Mentor
ruth.shallcross@pstt.org.uk

In our climate science section of this newsletter, we are bringing you a set of nature focussed cross-curricular activities for you to enjoy with your children.

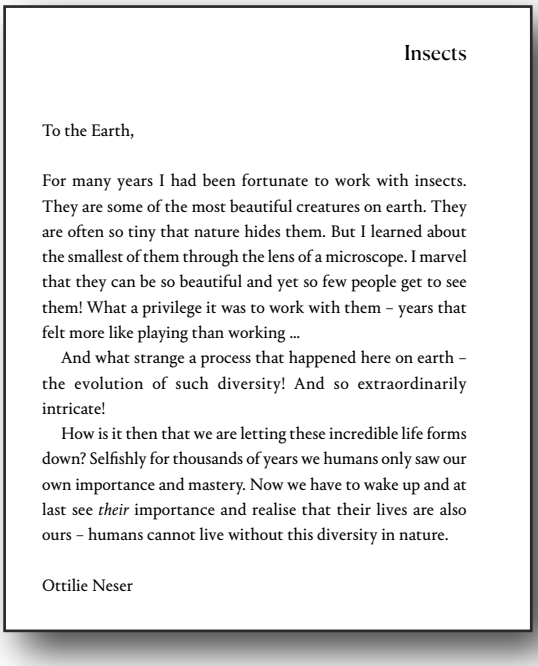
For us all, wellness is a priority and time spent in nature helps to reduce stress, which is vital at this time. What each of us does every day makes a difference. This starts with the thoughts we think and the experiences we are having. This then leads to the conversations we have and the words we write. Just one conversation can change the way someone thinks. Reading just one letter or poem can change the way someone feels.

All of the activities that follow will help children to strengthen their bond with the natural world and, through observation and reflection, enhance their appreciation for finer details which they may not have previously noticed. Both nature-themed reading and writing activities as well as some other practical and creative activities follow-on from this introduction.

LETTERS TO THE EARTH

Letters to the Earth is a collection of letters and poems which express human feelings about the climate crisis. In the book there are letters from children, parents, artists, actors, poets, politicians, songwriters and scientists. We would like your children to add their voices to the collection.

PSTT is delighted to be working with the Letters to the Earth team and Harper Collins publishers who have kindly given permission for us to reproduce a selection of letters written by teenagers or adults which may act as inspiration before writing. Each one comes with some questions for discussion.



Insects

To the Earth,

For many years I had been fortunate to work with insects. They are some of the most beautiful creatures on earth. They are often so tiny that nature hides them. But I learned about the smallest of them through the lens of a microscope. I marvel that they can be so beautiful and yet so few people get to see them! What a privilege it was to work with them – years that felt more like playing than working ...

And what strange a process that happened here on earth – the evolution of such diversity! And so extraordinarily intricate!

How is it then that we are letting these incredible life forms down? Selfishly for thousands of years we humans only saw our own importance and mastery. Now we have to wake up and at last see *their* importance and realise that their lives are also ours – humans cannot live without this diversity in nature.

Ottilie Neser

Can you find clues in the letter which suggest what Ottilie's job used to be?

Some words and phrases in the letter let us know exactly how Ottilie feels about insects. Can you find them?

How does Ottilie view humans? How do you know?

What does Ottilie want humans to do?

What is the overall message of Ottilie's letter?

Why do you think Harkiran gave the poem the title 'Sea Change'?

In line 5, Harkiran wrote 'Together you form a sea in an ocean'. Discuss what you think is meant by this.

Why did Harkiran use the word 'droplet' throughout the piece?

What is the message of this writing? How does it make you feel?

Sea Change

You may think that you are simply one small positive droplet in an ocean of troubles. A droplet that can't do anything. But if you search our ever expanding ocean you will find millions of other small droplets with the same mindset as yourself. Together you form a sea in an ocean. That sea can stir a storm. That sea can make a change.

Harkiran S. S. Dhingra, 15

I Believe in You

Dear Earth's Young People,

It has been an honour for us to walk on earth's sand at the beach, just so we can get a glimpse at the infinite ocean, and watch the glorious sun set and rise each day.

It has been an honour for us to walk up her mountains, hills, and travel by water, air, car, and walking.

Therefore, I ask you young people to encourage keeping her beautiful by respecting her, preserving her for years and generations to come.

One thing we can do for the people and planet is to grow a tree. I didn't see a difference between planting and growing until I saw a quote written by a Kenyan woman that said:

'Anybody can dig a hole and plant a tree. But make sure it survives. You have to nurture it, you have to water it, you have to keep at it until it becomes rooted so it can take care of itself. There are so many enemies of trees.'

You see the difference too? When we grow a 'lung of the planet', the air is purified and our people are given fresh strength.

Lastly, we can share with and teach other people the importance of preserving the planet.

If every person we know could take one small step towards being greener, the collective effort could be phenomenal.

I believe in you.

Yours sincerely,
Your friend, Molly Wingate, 16

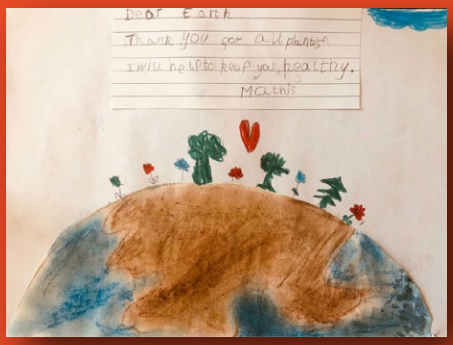
The word 'honour' is used in lines 1 and 4 of the letter. What does it mean?

In the letter there is a clear difference described between planting and growing. This description begins in paragraph 4. How would you explain it to someone?

In the 6th paragraph, Molly writes 'lung of the planet'. What is meant by this?

What does Molly want people to do?

Children around the world have responded to the invitation to write a letter to the Earth. Here are some of the letters that were received:



Dear Animals

Dear Animals,
The world use to be a safe place for you.
I am sorry we have ruined that.

Elliotte Mitchell, 12

Earth

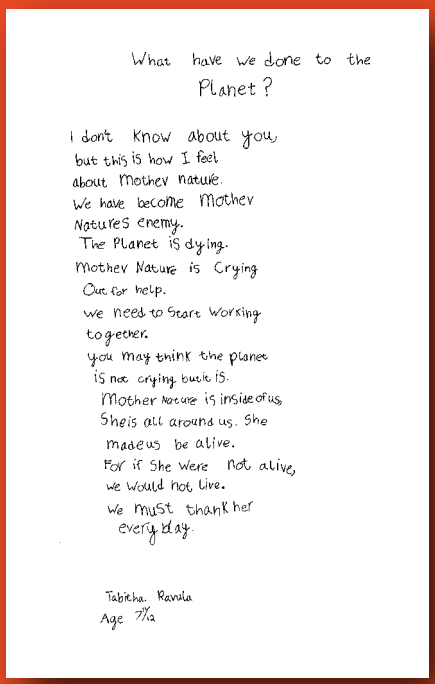
The earth's name is unique. We need to keep it.

E = Energetic
A = Amazing
R = Respectful
T = Trusty
H = Happy

The letters of the EARTH are what keeps us alive, without it we will be extinct.

Please forgive us for our mistakes.
It's up to us to support the earth.

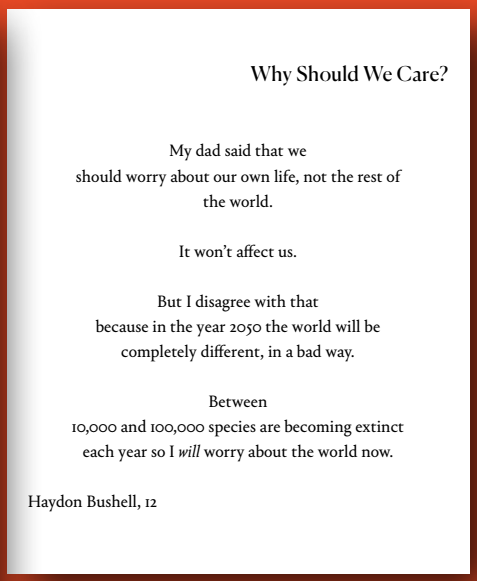
Emily Trenouth-Wood, 11



What have we done to the Planet?

I don't know about you,
but this is how I feel
about Mother nature.
We have become Mother
Natures enemy.
The Planet is dying.
Mother Nature is Crying
Out for help.
we need to Start Working
togeether.
you may think the planet
is not crying but it is.
Mother Nature is inside of us,
She is all around us. She
made us be alive.
For if She were not alive,
we would not live.
We MUST thank her
every day.

Tabitha. Ravula
Age 7½



Why Should We Care?

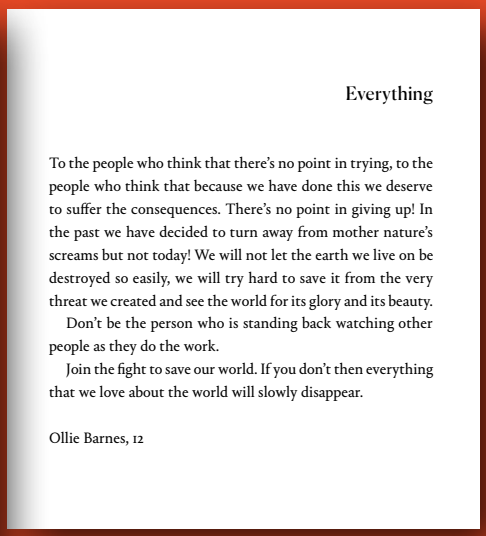
My dad said that we
should worry about our own life, not the rest of
the world.

It won't affect us.

But I disagree with that
because in the year 2050 the world will be
completely different, in a bad way.

Between
10,000 and 100,000 species are becoming extinct
each year so I *will* worry about the world now.

Haydon Bushell, 12



Everything

To the people who think that there's no point in trying, to the people who think that because we have done this we deserve to suffer the consequences. There's no point in giving up! In the past we have decided to turn away from mother nature's screams but not today! We will not let the earth we live on be destroyed so easily, we will try hard to save it from the very threat we created and see the world for its glory and its beauty.

Don't be the person who is standing back watching other people as they do the work.

Join the fight to save our world. If you don't then everything that we love about the world will slowly disappear.

Ollie Barnes, 12

WOULD YOUR CHILDREN LIKE TO ADD TO THE COLLECTION?

Before writing

To prepare for writing, it would be great to spend some time connecting with nature. This could be by gazing at the sky, taking a walk or carrying out one of the nature activities on the next pages.

To support planning, you could ask your child to think about:

- How does nature makes you feel?
- What is special to you about the natural world?
- What are your favourite sounds, smells, sights or tastes?
- Which textures do you like?
- What would you like to express?
- How do you feel about the climate crisis?
- Is there something you would like people to do or stop doing?

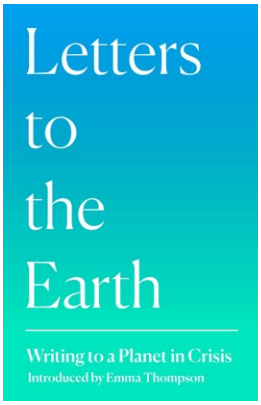
The next stage is planning. At this point it is useful to make some notes of words that spring to mind. These could be words detailing what has been seen, feelings, hopes or a call to action for humanity.

Useful planning prompts are:

- How would you like to express your relationship with nature and the Earth?
- Would you like to write about your love for nature and the beauty that you see around you?
- Perhaps there is a particular animal, plant or natural phenomenon, like rainbows, that brings you deep joy.
- Would you like to write about love, loss, anger, hope or action?
- Take some time to consider what feels most important to you today.

Whatever your child wants to write about is welcome. Then it is time to write a letter to the Earth. This could be a letter, poem, song, postcard or a picture. The letter could be written to the Earth or from the Earth, to future or past generations, to adults who have the power to make important decisions, to ordinary people or to other species (animals or plants). It could be written as a human or perhaps from the point of view of a bee, bird, beech tree or another species. Other ideas are also very welcome. Encourage your child to be creative and express themselves and to remember, that their words can make a difference.

Please send your letters to PSTT by using the form on our website. Click here for more information.



Letters to the Earth represents an on-going campaign in response to the climate and ecological emergency that you can be part of at **www.letterstotheearth.com**

If you are a parent or carer at home with your child, or a teacher in school, this series of nature-focused activities will support children to build a relationship with nature. Spending time outdoors and connecting with the natural world is a vital aspect of children wanting to care for it. By experiencing and talking about nature together, you can help your child or children to understand the importance and effects of nature in their lives.

NATURE WALK

Take your children on a nature walk. This can be done either in an urban or a rural setting. The focus is on noticing the nature that you see or experience whilst out walking. This could be plants pushing up between paving slabs, birds you hear singing or trees you walk past. If there is a park or other large green space to visit, take time to enjoy that together.

You could:

- Discover a favourite local tree and take a photo of it each week to observe how it changes over time.
- Find an item that interests you (e.g. a pine cone, pebble, fallen leaf or twig) and pick it up to take home with you as a memento of your walk. Make sure your child does not pick any live plants.
- Create a journey stick (**click here for more information**)

Question prompts:

- What do you see/hear/smell?
- Can you describe it in detail? Can you tell me more?
- What do you see if you look more carefully? Do you notice any new details?
- Does it remind you of anything else you have seen before?
- What else would you like to know about it?
- How does it make you feel?

NATURE OBSERVATION DRAWING

Take time to observe nature closely by sketching. This can be done at home with an item that you have brought home from a walk or with a natural specimen that you have around your home e.g. a feather, shell, stone, twig. Spend some time looking very carefully at your chosen specimen. Take time to notice the details of the colour, textures, shape and shades of the specimen. As you sketch, pay attention to the details you are drawing but don't worry too much if your drawing doesn't look exactly like your item.

You may also be interested in entering the **Nancy Rothwell specimen drawing competition** - please see **LINKS** section at the end of this article on page 11.

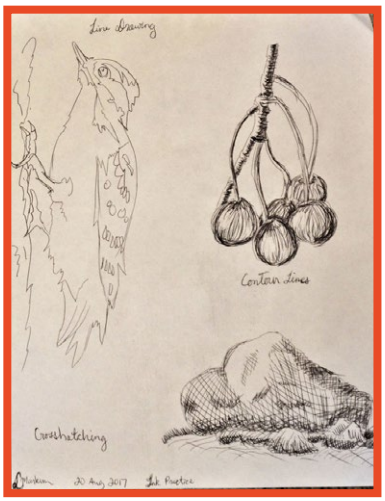


PHOTO DIARY

Choose a spot at home or out on your daily walk to photograph each day. This could be a view from one of your windows looking at the sky, a favourite natural place which you see out on your daily walk or a scene in your garden if you have one. Try to take a photo of your chosen place at the same time every day, including some of the sky. This will become a photo diary where you can see changes in nature and the weather over time. Once you have taken the photograph, look closely to see what you notice and compare the photos over time. Think about what changes and what stays the same. If you have a printer, you could make a scrap book and write notes around the photos or you could add the photographs to the notes feature on a phone or tablet and write your observations there.

The Royal Society of Biology's 2020 Photography Competition has the theme Our Changing World. See details in the **LINKS** section below for how to enter.

TIME LAPSE PHOTOS

Time lapse photography is a great way to observe changes over a longer period of time condensed into a shorter film. Apps can be downloaded onto smartphones or tablets for this purpose. You could take pictures of:

- A piece of fruit or a vegetable decaying
- A plant growing
- Growing a vegetable scrap – carrot tops or celery are great for this. **Click here for more information**.
- A pale flower placed into food colouring

LINKS

For science investigations visit **www.science-sparks.com**

Lessons which explore the work of Charles Darwin and highlight the importance of being outdoors to the development of his scientific ideas.

Royal Society of Biology competitions

The Nancy Rothwell Award 2020

The Nancy Rothwell Award 2020 specimen drawing competition for 7 – 18 year olds is now open for submissions by 31st July. Prizes include an experience day at the Royal Veterinary College for students, and their school can also win £100.

Photography Competition 2020

'Our changing world' is the theme of this year's Royal Society of Biology Photography Competition. Life on Earth is dynamic, and we invite you to capture these transformations. The competition has two age categories each with a cash prize: 18 years old and over (£1000) and under 18s (£500). Submit your images by 24th July.

Ruth Shallcross works full time for the Primary Science Teaching Trust as Regional Mentor for London and the South East. She is currently leading the development of PSTT's Climate Science Project 'Educating for a Future' which, by working in collaboration with academics and projects, aims to empower children with accurate scientific knowledge to understand the principles of climate change and some of the solutions.

SUPPORTING SCHOOL CLOSURES AND HOME LEARNING

SUPPORT FROM PSTT

SCIENCE AT WORK

We are working with **Spectrum Drama** and **St. Mary's University** to create opportunities to meet past and present scientists and to learn more about people who do jobs that use science. Science at Work consists of weekly activity sheets about scientists and people who work in a science-related job. Children are encouraged to send in their questions to the scientist who will answer as many as they can in a video released the following week.

Key things you need to do to take part.....

- Download the **activity sheet** about the scientist or person who uses science in their job. These are released on a Tuesday, but will be sent straight to your inbox if you are signed up to our mailing list.
- On the Science at Work webpage, click on the **SEND US YOUR QUESTION** tab and complete the form to **submit the child's question** and/or upload their drawing by **3pm on Thursday** the same week.
- The **following Tuesday watch the video** - the link for this is on the webpage and also on the activity sheet.

All the activity sheets and videos will remain available on the Science at Work webpage so children can still enjoy doing some research about the scientists. When they watch the video, their questions may still be answered, even if they haven't sent any in themselves.

SCIENCE FUN AT HOME

We are working with **Science Sparks** to create activities for children to have some fun with science at home.

Each two page sheet has activities that are:

- clear and simple, using household resources
- accessible and manageable for all
- fun for children and their families to do
- linked to follow up activities

A new Science Fun at Home activity sheet is released every Wednesday. You can also receive these activities direct to your inbox by signing up to our mailing list. Please share these resources with other schools, parents, guardians and carers, and encourage them to pass them on to other families.

The Science Fun at Home page also has two other sets of PSTT activities that would work well for children to do during school closures.

Engineering Our World - 8 engineering challenges and fact sheets which introduce famous scientists, engineers and artists.

Challenge Chasers - 8 science activities presented as challenges to solve for older primary children (ages 7-11 years).

See Through Science

Using photographic images to engage and inspire children to ask scientific questions about the world around them

SPECIAL ISSUE

FREE TO DOWNLOAD

To support teachers and families during school closures, **PSTT Fellows Dr. Paul Tyler and Alex Farrer** have written a second issue of their highly successful book, ***See Through Science***. They have selected eight images designed to encourage children to think, to question and to discuss. The images cover a range of scientific phenomena and different applications of science. Each image comes with one or more key questions/clues, a small amount of background knowledge and suggestions for further activities.

Using the images

- Children will get the most out of using the images if they can discuss in a group, or have a discussion partner– this could be a teacher, parent or carer.
- You need to be able to show the children the images without them being able to see the information about each. **For a downloadable version containing only the images and key questions please click here.**
- Show the children one of the images with the key question, either on a screen or printed onto paper
- Read the key question together
- Encourage the children to share all the ideas they have, however unlikely they may seem
- Ask the children to discuss all the ideas and think about what sort of questions it would be helpful to ask
- If needed, give the children some clues or answer their questions
- Once the children have discovered what the image is, follow the suggested links to find out more

For more information about the original See Through Science resource please **click here**. The book includes fifteen high-resolution digital images (included with the book as a digital download) and is packed with practical advice for teachers about using the image pack to develop children's observation, questioning and discussion skills.

Dr. Paul Tyler teaches at Kirkhill Primary School and has been a Fellow of the PSTT since 2013. He specialises in primary science and is especially interested in developing children's curiosity and scientific questioning skills. He has written several articles on aspects of primary science and speaks at conferences nationally.

Having had an advisory role for science in Richmond and Kingston for many years, **Alex Farrer** is now Head of STEAM at Wimbledon High School. She is delighted to be one of the PSTA winners for 2019. Alex is an experienced PSQM hub leader and led her own school to gain a PSQM Outreach Award last year.

With permission Brian Prout

Where have you seen this writing? Can you find out what the whole sentence says? Can you find out who said it?

CLUES

This writing is around the edge of something...

You'll need to look very closely as the letters are small...

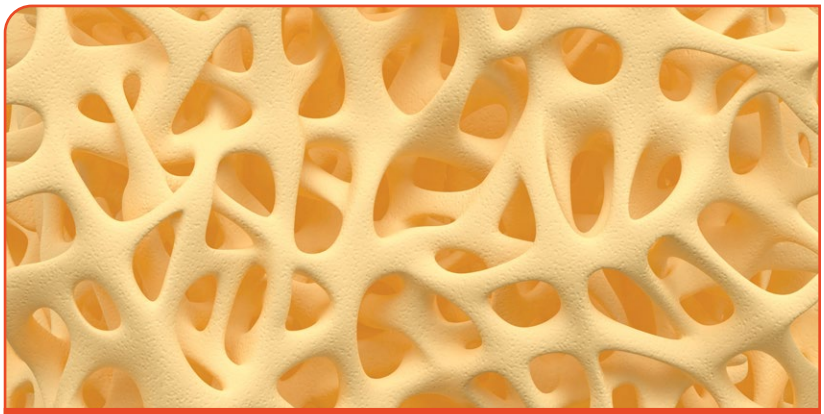
The object you are looking for would fit in your pocket or a purse...

FURTHER INFORMATION

Sir Isaac Newton famously once said "If I have seen further it is by standing on the shoulders of giants" meaning that he made his discoveries by building on the work of other scientists. He was a very influential mathematician, physicist and astronomer who's work on the laws of motion and gravity shaped all our lives. His words are now around the edge of £2 coins.

You could try using a fridge magnet to find out which coins are magnetic. How will you record your results? How will you explain your results? Some information that might help can be found by clicking below.

Magnetic coins >



There is a large amount of this material in your house. What is it? Can you work out what properties the material might have?

CLUES

Look at the connections – this is a very strong, but flexible material!

This material is as strong as stainless steel but three times more lightweight.

This material is very durable but starts to wear out after 60 – 80 years.

This very amazing material is inside all of us!

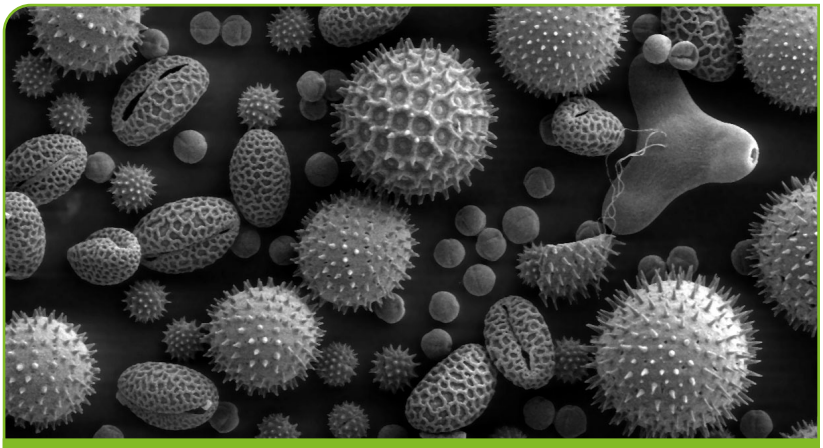
FURTHER INFORMATION

NASA training >

It's human bone!

Human bone is an amazing material. It has unique characteristics that make it superb at withstanding the rigours of life such as jumping, standing and running. It is flexible yet strong, lightweight but durable, and it can repair itself.

Astronauts have to do exercises to make sure that the lower gravity in space doesn't cause their bone density to decline. Why not try out some crew strength training with NASA astronauts so that you can improve your bone density too? Join in with the NASA squats and pushups by clicking the link above.



What do you think has been magnified in this photograph? Look very carefully at the shapes you can see and the similarities and differences between them.

CLUES

There is lots of this outside at the moment..

This comes in many different colours...

You can sometimes find this stuck onto the legs of bees.

This causes lots of people to have hayfever.

FURTHER INFORMATION

It's pollen! You can find out more about pollen by clicking the link below.

You could use a hand lens or a microscope to look at some other things very closely, but don't worry if you can't as you can use this great website instead.

Pollen >

Microscope website >

Look very carefully. Can you think of 5 words that this photograph makes you think of?

MY WORDS ARE

bird

camouflage

tuft

patterns

predator

Can you think of 5 more words?

FURTHER INFORMATION

This owl has feathers that are dull in colour and look very similar to the environment it hunts in. If the owl keeps very still it will be very hard for its prey to spot it. Having feather patterns that look like tree bark and tufts that break up its outline are very useful adaptations that help make owls very successful predators. What other adaptations do you think an owl has that make it such a successful predator? Find out more about camouflage with this activity on page 21 of the British Science Week pack.

British Science Week pack >

Spider webs are amazing. What do you think has happened here? What will happen next? Where is the spider? What clues can you find in this photo?

MORE QUESTIONS

See if you can find a spider's web. Maybe you can draw a very careful diagram of it. Maybe you can also draw and label a detailed diagram of the spider that made the web. Can you work out the species of the spider from the shape of the web? More help is available for identifying the spider in the link below.

Identifying spiders >

FURTHER INFORMATION

Spider web silk can be 5 times stronger than steel but 1000 times thinner a human hair! There are 660 different species of spider in the UK and the shape and structure of their webs can help identify the spider that lives there. Find out more by clicking below.

Spider webs >

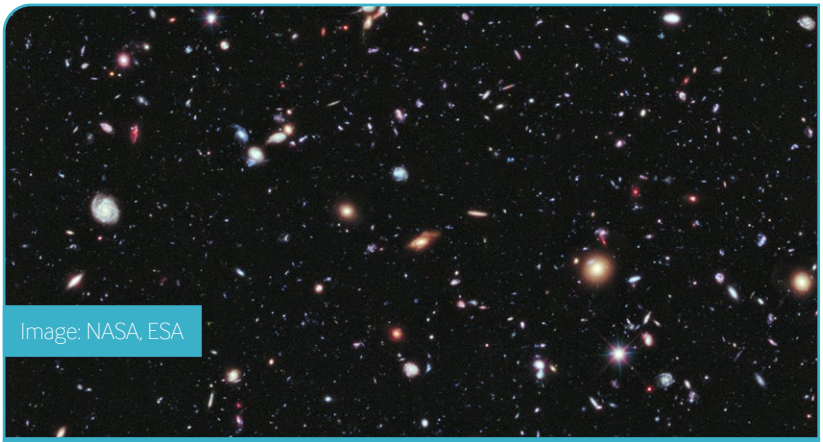


Image: NASA, ESA

What five questions would you like to ask about this photo?

MORE QUESTIONS

What do you think this photo shows?

How do you think it was taken?

Why is it such an important image for astronomers?

Read more about this amazing image >

FURTHER INFORMATION

At first glance the photo looks like it is a collection of stars, but on closer inspection it becomes clear that they are not stars but a variety of differently shaped, and coloured objects. You can explore it in more detail by clicking the link below.

The image is the Hubble Ultra Deep Field image and only contains 5 stars, can you spot them, and what makes them different? The image contains nearly 10000 galaxies and is a snapshot through the history of the universe. There are galaxies in the photo that are nearly 13 billion years old, and others that are new – about 1 billion years old.

Explore the image further >

Explore the scale of the universe >

Where do you think this photo was taken?
How was the photo taken?

CLUES

It wasn't taken on Earth.

This robot rover is exploring the most visited planet in our Solar System.

The colour of the surface is a big clue as to what planet this is.

FURTHER INFORMATION

This is the Curiosity rover exploring the surface of Mars. Curiosity was launched in 2011 and following a traumatic landing on the Martian surface, it became the fourth rover successfully landed on Mars.

Why don't you explore the Solar System with the amazing interactive animation in the link below.

Curiosity Mars Landing > **Explore the Solar System >** **More about the Mars Rovers >**

What is this? Think of 5 questions to ask to try to find out the answer. All of your questions have to be able to be answered YES or NO.

HELPFUL QUESTIONS

Good questions to help find out the answer might be:

Is it made of metal?

Have we got one in our house?

Is it an animal?

FURTHER INFORMATION

It's a propeller on a boat!

A propeller is just one way of making a boat zoom across the water. Click below for a more unusual way that you might want to have a go at.

Soap powered boats >

SUPPORTING SCHOOL CLOSURES AND HOME LEARNING

SUPPORT FROM OTHER ORGANISATIONS

We work closely with many organisations who have also been busy putting together special resources and support for school closures and home learning.
We are delighted to be sharing these various initiatives here.

THE ROYAL SOCIETY

At The Royal Society we have resources for primary and secondary students as well as an extended resources section which is geared towards those students who are passionate about science and want to explore more themselves. You will also find links on here to other widely-available resources.

ROYAL SOCIETY OF CHEMISTRY

Are you looking for new ideas for teaching primary science? The **Royal Society of Chemistry's education website** has a wealth of free resources including videos, podcasts and practical demonstrations. Check out our **primary teacher support page** for weekly themed resources, online sessions and our new 'Chemistry in your cupboard' videos - perfect for home learning!

IOP Institute of Physics

We at the Institute of Physics want to make it easy for parents and carers to get their children excited about science. That's why we've launched **Do Try This at Home**, a series of fun physics activities, with short demonstration videos and simple, step-by-step instructions. Start with the rubber band bass guitar, then test out the waterproof hanky and explore the amazing shrinking coin, these short videos were filmed in the kitchens and living rooms of our team of expert science communicators, based around the UK and Ireland. They use basic household materials in inventive ways to demonstrate physics, with accompanying step-by-step instructions and simple explanations of the science behind it all.

The Ogden Trust

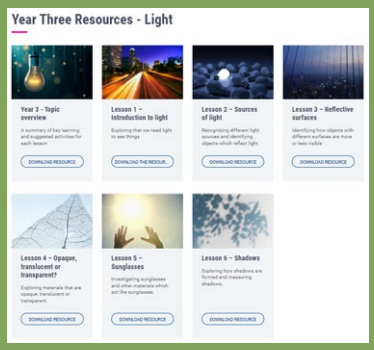
making physics matter

The Ogden Trust provides support for the teaching and learning of physics topics in primary science (forces and motion, light and sound, earth and space, and electricity). Our **resources page** has a range of activities for all ages from 3-11, many of which can be carried out with simple things around the house. You can filter the resources by age group and topic to find what you are looking for. We have also put together a list of **great home learning resources by others**, broken down by key stage.

The Association for Science Education

The ASE Primary Science committee has written lessons for primary-aged pupils which are designed to be directly accessible to children and parents at home to help deliver a structured series of topic-based primary science lessons in a home environment.

The key learning objectives are aligned to the National Curriculum for England but are also relevant to learners across the UK. There is guidance for parents, explanations of key concepts, suggested activities for pupils and examples of possible learning outcomes to make it easier for parents to support the learning. Throughout the lessons, we have provided links to video clips and resources hosted by external organisations. The primary resources on the ASE coronavirus hub can be found **here**.



lightyear foundation | SENSORY SCIENCE

The Lightyear Foundation aims to breakdown the barriers to disabled children taking part in STEMM activities and careers. We have lots of support on our website for SEN and science. In particular, please see **our webpage** for some Covid-19 STEMM themed resources for children.

Royal Society of Biology

At the RSB we have been working to provide advice and support to teachers, parents and students during the Covid-19 pandemic. We now have new education during Covid-19 web pages that will be regularly updated over the coming weeks and months. **These web pages** offer advice for students age 5-19.

Alongside the web pages are links to resources and how to access our **online Gopher Science Lab** which is now free for parents to access for six months. In addition, the Biologist digital archive has also been made free for schools for the next 6 months.

THE FARADAY INSTITUTION

The Faraday Institution has researchers across the UK aiming to design new pioneering batteries to improve electric vehicles, mobile phones and other applications as we strive for a more sustainable future. Why not learn more about going fully electric. For schools still open for key worker children, check out the **Faraday 'Fully Charged Battery Box'**. For home science try **'Crunchie Bar Batteries'** – videos of fun experiments which come with easy to follow **instructions**. For further information contact Fran Long, PSTT Fellow fran.long@faraday.ac.uk

sserc

SSERC is providing a number of ongoing support initiatives for STEM home learning. Visit our **home learning page on the SSERC Website** to access the resources.

SSERC STEM Bulletins provide ideas for practical STEM activities, using readily available resources. Bulletins can now be accessed via the SSERC home learning page and shared freely with colleagues, parents and carers.

SSERC posts a STEM Share activity every Tuesday at 10am via SSERC TV. These short videos are designed to support practical STEM learning at home - all the videos can be found **here**.

So far there are short videos that focus on science inquiry, pneumatics, sound, science pocket books (inspired by PSTT Fellow Janet Barnet), balloon rockets and friction.

Find links to the SSERC STEM Share activities:

via Twitter @SSERCprimary

and Facebook www.facebook.com/ssercprimary

SCIENCEOXFORD

At Science Oxford we have launched new online resources for all ages. We are creating a series of weekly Science Oxford Challenges – like coding a rainbow of hope for your window or making your own creature creation – and a Bright Idea or STEM-themed talking point to discuss at school or at home. We're also scouting the web for the very best STEM resources to share. You will find all the new resources on **our website** and shared on our social media channels – **@scienceoxford** on **Facebook**, **Twitter** and **Instagram**. We've also started moving some of our teacher CPD online and will be training a new group of Thinking, Doing, Talking Science trainers remotely.

STEM LEARNING

STEM learning online support includes a **Home Teaching page** which is designed to support teachers to continue educating young people while they are at home. This includes free resources, tips from our subject experts and professional development opportunities. Information about the remote CPD offer can be found **here**.

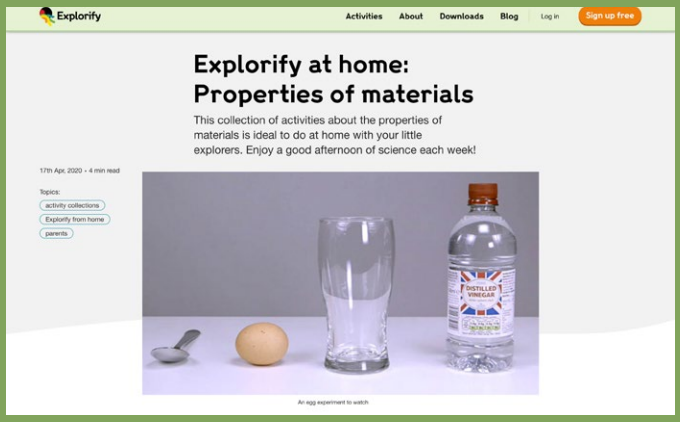
The **Home Learning page** highlights resources that can be used at home to support learning. The **'Starters for STEM'** resources are particularly useful if you are looking for something quick and easy to share with parents.

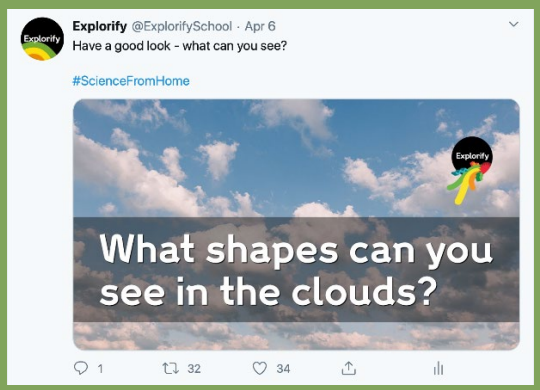
Explorify at home is a special series of science activities for primary school children who are now learning at home. Teachers can sign-post parents & carers to these 10 fun and easy-to-do curriculum-linked activity collections. Each collection covers a different science topic and has specially selected Explorify activities, as well as simple hands-on activities using things around your home. Everything can be found **here**.

The activities are arranged by age and curriculum topics in Explorify, however these collections are also suitable to do all together as a family of mixed aged children. Or if your little scientist just wants to explore further, pick something from the other age sections for inspiration!

The collections are: Properties of Materials, Plants, Classification, Forces, Habitats, Materials and their uses, Human Body, Sound, Fossils & Evolution, Seasons, Light & Space, and link to the **BBC's Bitesize Daily science content** (ready to watch every Wednesday).

#ScienceFromHome: Don't forget to look out for our simple daily activities on Twitter (**@ExplorifySchool**) and Facebook (**facebook.com/groups/explorifystaff/**) that children can do from home.





Are you part of the **2020 Great Science Share?**

This fast-growing, annual campaign inspires primary and lower secondary children to share their scientific questions with new audiences. A swift tweak of strategy means the Great Science Share isn't just alive – it's thriving with new weekly themes, investigation sharing, grooves and Youtube Lives. All aimed at stimulating young people, families, teachers and STEM organisations to get involved in sharing their scientific questions.

Having reached over 100,000 young people, we were determined the 2020 campaign would go ahead despite the current challenges. We have been overawed over with the support that so many organisations and groups have given, including that of PSTT, which has meant that registrations continue to rise. Registration will remain open until the end of July!

HOW IS IT WORKING?

Basically, it's as simple as young people being supported to ask and share a scientific question they are curious about. There are 3 ways we've supported this.

1. Question Asking: 5 engaging weekly themes have been sparking interest in topics related to the Global Sustainability Goals - from space to waste, from oceans to wildlife. Each theme links to a range of free, on-line resources harvested from a wide range of STEM organisations. A brand new **GSS Question Maker** focuses on the art of question asking – something that we know gets better with inspiration and practice. All these resources remain available at www.greatscienceshare.org.

Then share your favourite scientific questions each week in creative ways via Twitter, email or Facebook: send a text tweet, make a poster or a short film stating the question... how to share is up to you.

2. Investigation Sharing: will be the focus of the 16th June 2020. Everyone can take part. It can be a science investigation linked to one of your favourite questions, something you've done before, something you've watched someone else do and all those investigations you've been involved with since lockdown. Share your science using GSS Magazine entry form or in a creative way you prefer. We'll pop all that we receive into a gallery celebrating great science in 2020!

3. Groove-along: the link to arts and culture is always a feature of a Great Science Share. This year a mass move-along encourages you to share science in a different way. Everyone can take part – create a short film and send it to greatscishare@manchester.ac.uk or tweet it out. There's still time to get involved.

Remember to register: everyone will receive the 2020 certificate, targeted information and be part of a free prize draw for the children's school.

You can catch up with the weekly Youtube Live Science with @DrChips_ Wonder Wednesday's in partnership with GSS on https://drchips.weebly.com/

Get connected and use the hashtag #GreatSciShare

Twitter: **@GreatSciShare**
Email: **greatscishare@manchester.ac.uk**

Many thanks to the Primary Science Teaching Trust, the PSTT College Fellows, Regional Mentors and associated colleagues for all their encouragement, support and inspiration. Acknowledging key sponsors including BASF, The University of Manchester, ZenEducate, Association for Science Education, Practical Action, Manchester City Council and Siemens. Our thanks also extend to each one of the STEM and educational organisations and businesses who have gone the extra mile to collaborate with us!

I BET YOU DIDN'T KNOW...

The science of hand-washing

Dr. Rebecca Ellis, PSTT Fellow, links **cutting edge research** with the **principles of primary science**

rebecca.ellis@pstt.org.uk

Recently, we have been told again and again of the importance of washing our hands to prevent the spread of COVID- 19 (the 2019-2020 Corona virus). If you think that hand-washing is old news, you are correct and in a slight change from the usual 'I bet you didn't know...' articles, we will explain the older science of hand-washing before looking at current, cutting-edge research in the field.

For centuries, hand-washing has been part of good personal hygiene. Then about 200 years ago, following observations from doctors and nurses (including Dr. Ignaz Semmelweis and Florence Nightingale), medics dramatically reduced the death rates of their patients by improving their own hygiene routines. Being clean became vital and was the cornerstone of modern medicine long before anyone knew about the microbes that caused disease.

Click here to watch the BBC Teach class clip and find out more about the life of Florence Nightingale.

PSTT has also recently released an excellent video about Florence Nightingale in its new 'Science At Work' series to support learning from home.
Click below to find out more about Florence's life as she answers primary school children's questions about her life and work.

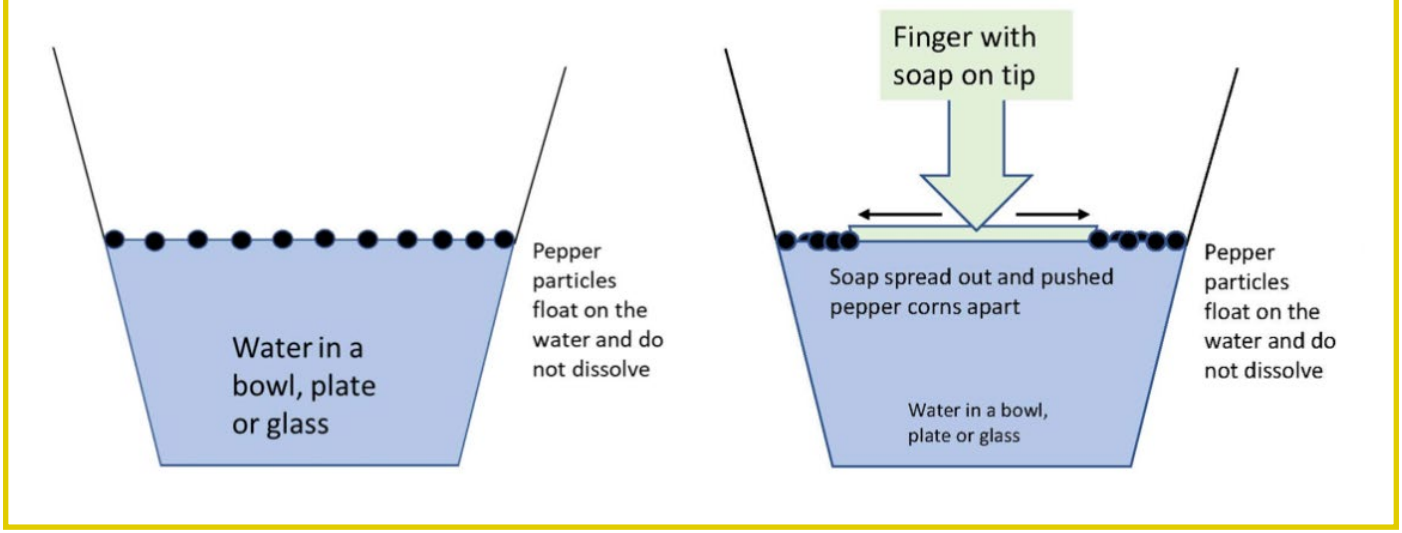
Surprisingly, there are still scientists today investigating hand hygiene and they think refining and improving how and when we wash our hands could be an important way of reducing infection rates. These scientists point out that we appreciate complicated, clever, new solutions more than the older wisdom of hand hygiene and as a result have sometimes failed to optimise the benefits of hand-washing thoroughly and consistently. If we want to persuade everybody, not just doctors and nurses, to maintain good hand hygiene, it is important that people understand the chemistry of cleaning a little more deeply...

Let's begin by thinking about why soap is so important.

Try this simple investigation. Pour water into a glass dish and sprinkle pepper over the surface. The pepper does not dissolve in the water. (Can you think of substances that would dissolve in the water? Can you remember what happens to substances when they dissolve?). Tiny pepper particles do not dissolve, and due to the surface tension of the water and the fact that they are so light, they float on the surface of the water. Cover the end of your finger in some liquid soap and dip it into the surface of the water. Observe closely.

The rapid movement of the pepper particles away from the finger to the edges of the dish is caused by the soap; but how? Well, the molecules of soap are hydrophobic which means that they hate water! To minimise how much they touch the water, they form a layer across the surface of the water and as they do this the pepper particles move to the edges (figure 1).

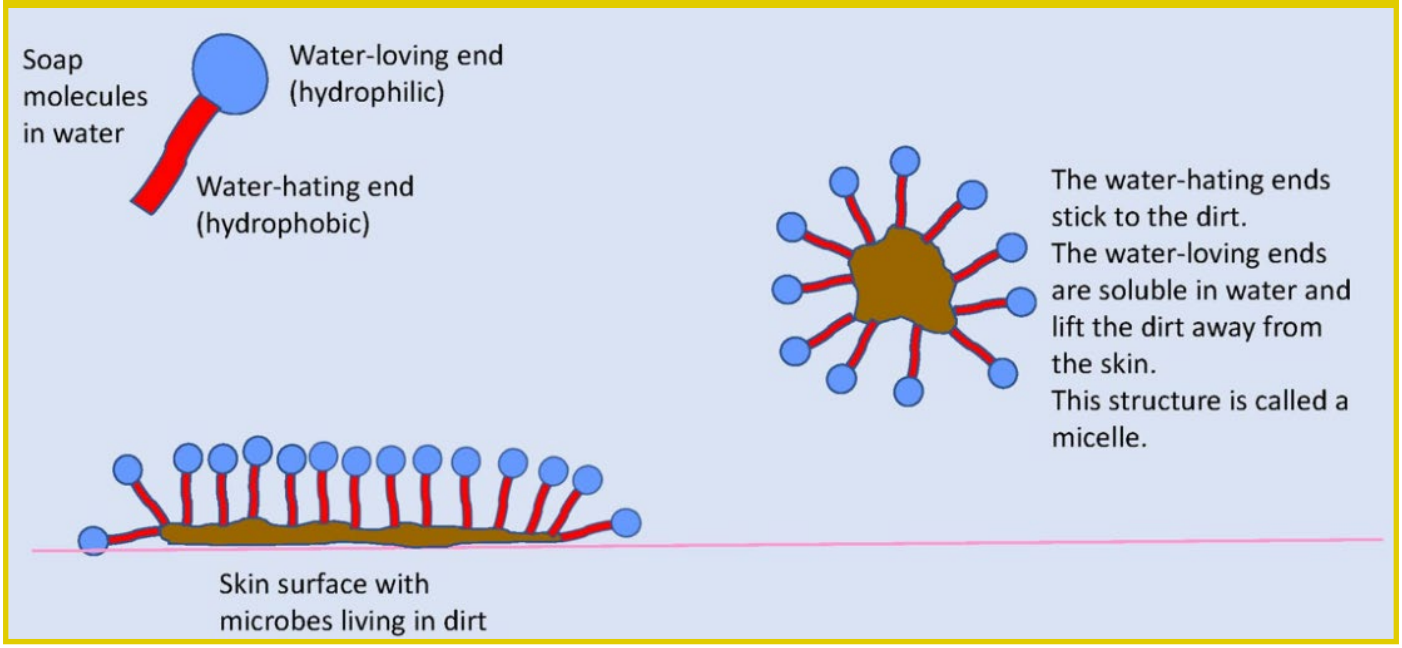
Figure 1. Demonstration to show that soap molecules spread across the surface of water because they are water-hating (hydrophobic).



Repeat your investigation with another hydrophobic substance like cooking oil. Does the same thing happen? Make a prediction and then observe similarities and differences. Try slowly pouring some of the oil into the centre of the container. Can you see the layer of oil spreading out and pushing the pepper particles away?

After this experiment, you might ask yourself why we don't use oils to clean if they work in a similar way to soaps? In fact, the Romans did use olive oil to clean themselves, but they found that they needed scrapers (strigils) to scrape it off their skin, since it doesn't rinse away with water. However, luckily for us, other cultures, as far back as 2800 BC, found that boiling oils with ashes produced a product that cleaned **and** rinsed away. The science behind this is very interesting because as well as being hydrophobic (water hating), soap molecules are also hydrophilic (water loving). To understand fully, you need to look closely at the molecules of soap and what happens when we use it to wash our skin (Figure 2).

Figure 2. Schematic diagram to show how soap molecules lift dirt away from the skin.



Our skin produces natural oils to keep it healthy. Dirt tends to mix with these oils as we touch surfaces and go about our daily life. Scientists have found that the tiny droplets of sputum (containing bacteria and viruses) which are coughed, sneezed or even breathed into the air, often settle on surfaces, so even when our hands don't look dirty, they may be!

The hydrophobic parts of the soap molecules arrange themselves next to the patches of oil, dirt and microbes on the skin. Meanwhile the hydrophilic parts, which are attracted to the water, lift the dirt to form structures called micelles. These are like tiny floating balls of dirt coated in soap and they easily disappear down the plug hole where they won't bother you.

Can you use household recycling to make a collage of a micelle? Use it to explain how soap works to someone else.

What about hand sanitizers? Surely, they are more effective than soap because the alcohol they contain can actually kill the virus rather than just wash it away? In a recent study of the influenza virus, scientists in a hospital compared antiseptic hand-washing with rubbing on ethanol-based hand disinfectants. They found that when they tested the virus in droplets of saline (salty water), the rubbing of hand sanitizer worked well – the virus was completely inactivated after 30 seconds. However, it took 8 times longer than this when they tested the virus in sputum (which is a thicker, stickier substance). In contrast, the hand-washing method worked in 30 seconds whether the virus was presented in saline or sputum. Most scientists now recommend to the public to wash their hands for about 20 seconds with warm water and soap frequently during the day and always before eating or touching their faces. Hand sanitizers remain useful when you can't wash your hands.

Click here to watch the NHS video guidance about how and when to wash your hands.

Glossary

Hydrophobic: *something that tends to repel or fail to mix with water.*

Hydrophilic: *something that tends to mix with, dissolve in, or be wetted by water.*

Micelle: *a roughly spherically shaped grouping of molecules contained in a liquid.*

Saline: *a solution of salt in water.*

Sputum: *a mixture of saliva and mucus coughed up from the respiratory tract, typically as a result of infection or other disease.*

The research paper that generated this work was:

Situations Leading to Reduced Effectiveness of Current Hand Hygiene against Infectious Mucus from Influenza Virus-Infected Patients

Ryohei Hirose[1,2], Takaaki Nakaya[2], Yuji Naito[1], Tomo Daidoji[2], Risa Bandou[2,3], Ken Inoue[1], Osamu Dohi[1], Naohisa Yoshida[1], Hideyuki Konishi[1], Yoshito Itoh[1]. (2019) *mSphere Sep 2019, 4 (5) e00474-19 https://msphere.asm.org/content/4/5/e00474-19 last accessed 18.05.20*

[1]*Department of Molecular Gastroenterology and Hepatology, Graduate School of Medical Science, Kyoto Prefectural University of Medicine, Kyoto, Japan*

[2]*Department of Infectious Diseases, Graduate School of Medical Science, Kyoto Prefectural University of Medicine, Kyoto, Japan*

[3]*Department of Forensics Medicine, Graduate School of Medical Science, Kyoto Prefectural University of Medicine, Kyoto, Japan*

I BET YOU DIDN'T KNOW...

What small magnetic robots can do

Dr. Alison Trew, PSTT Area Mentor and Website Resources Developer,
links **cutting edge research** with the **principles of primary science**

alison.trew@pstt.org.uk

You have probably seen robots in documentary programmes or in TV dramas, but have you ever wondered what makes them move? To start an object moving, stop it moving, change the speed or direction of the movement, or to change its shape, requires a force. Such a force could be caused in many ways, including use of electricity, magnets, gravity, air (hydraulics) or liquids (pneumatics).

A typical robot has a movable physical structure, a motor of some kind, a power supply (probably electricity), a sensor system, and a computer 'brain' called a central processing unit (CPU) that controls all these elements. You could investigate how different forces cause objects to move (suggestions are provided in the *Teacher Guide, downloadable via the PSTT website*).

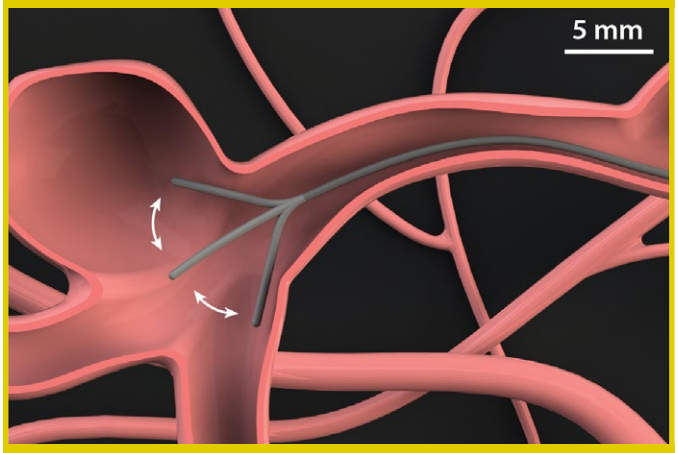
Snake-arm robots, also described as continuum robots, have continuously curving manipulators that can move like the arm of an octopus, bending and sometimes twisting at any point along their structure. These have been developed to reach into confined or dangerous spaces not accessible to traditional robots. They are being used for repair and maintenance in the nuclear industry, car and aeroplane manufacturing, bomb disposal, and search and rescue. Steering occurs either by a system of opposing pulling wires and springs (Figure 1) or by controlling embedded magnets. Small-scale continuum robots capable of navigating through complex and constrained environments have great potential for medical applications. Surgeons can access sites inside the body such as arteries around the heart and lungs for making diagnoses and non-invasive treatments. However, miniaturizing continuum robots is difficult because it is problematic to manufacture the antagonist wires or magnets to sub-millimetre diameters. Their relatively large size makes them too large for accessing blood vessels in the brain or spinal cord (neurosurgery).

Figure 1. An elephant trunk robotic arm which is operated by a system of guide wires and springs.

Soft-bodied robots made of silicone with internal chambers using hydraulic or pneumatic systems are also being developed. Inside one type of soft-bodied robot, hydrogen peroxide washes over tiny flecks of platinum, producing gas through a chemical reaction. The gas flows through the chambers, inflating and moving the robot's arms (search 'Octobot' online). Such robots could one day be used for oceanic search and rescue or climate sensing. Their uses in surgery are limited because they are also difficult to miniaturize below millimetre scales.

Recently scientists have developed 'ferromagnetic soft robots' with a diameter of less than 1mm that can travel through small vessels inside the body (Figure 2). The

Figure 2. A soft continuum robot inside a blood vessel.



From Kim et al., Sci. Robot. 4, eaax7329 (2019)*.
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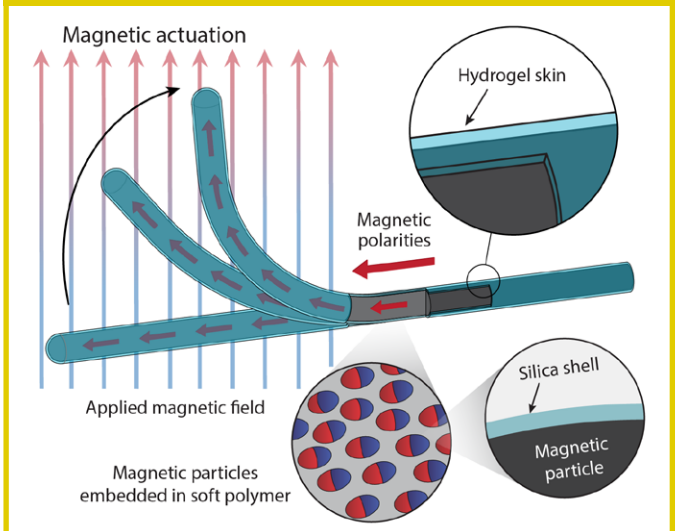
robots are made from microparticles (less than 5µm in diameter) with a high iron content which means that they can be magnetised. These particles are embedded in a soft gel-like material (silicone or thermoplastic polyurethane (TPU)). When these materials are mixed, they form a paste and the robot can be made by printing or injection moulding. The tip of the robot containing the magnetic particles moves when a magnetic field is switched on remotely (Figure 3).

The thickness of the silica shell coating increased the volume of the magnetic particles. You might wonder why the scientists did this, when these robots need to be kept extremely small to be used inside tiny blood vessels. The answer is because the magnetic particles have a high iron content and iron is highly corrosive (reactive) in a wet environment. The corrosion of iron could be explored in the classroom (see details in the Teacher Guide): rust (iron (III) oxide) is an example of a chemical irreversible change that results when iron is exposed to water (e.g. from damp air). A thin film of oxide forms on the iron; this protects the metal from further corrosion by slowing the rate of oxidation.

The researchers tested the movement of the robot through a series of rings using a single magnet to control its movement. They compared different diameters of robots, and different types of soft materials at the tip, to find a robot that can make sharp turns and that will be able to move through complex blood vessel systems.

They then tested the movement of the soft robot

Figure 3. The structure of the magnetic robot. Magnetic particles arranged in the same direction are embedded in a soft material (bottom left circle). Each magnetic particle is surrounded by a silica shell to prevent the magnets corroding (bottom right circle). The surface of the robot is covered by a water-loving gel (hydrogel) skin to reduce friction when the robot moves through vessels (top circle). The magnetic tip of the continuum robot moves when a magnetic field is switched on.



From Kim et al., Sci. Robot. 4, eaax7329 (2019)*.
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through silicone tubes filled with a blood replica (which they called a 'vascular phantom'). They measured the forces required to pull a cylindrical object with and without a hydrogel skin through the phantom vessels and showed that the hydrogel was important for reducing friction. They compared the soft robot with traditional guide wire robots and showed that the traditional robot was jerky and took longer to travel through the phantom vessels. They also included an optical fibre to demonstrate that magnetically steerable laser treatments might be possible in neurosurgery in the future.

In the classroom, it would be possible for children to create models of these soft robots travelling through rings or tubes and use them to explain their understanding to others. Plastic or cardboard tubes are easily sourced and paperclips or a split pin attached to a string representing the robot could be steered using a cylindrical or bar magnet. Investigations could include which is the 'best' magnet to control movement or the 'best' robot body for navigation.

The research paper which inspired this work was:

**Ferromagnetic soft continuum robots* By Yoonho Kim[1], German A. Parada[1,2], Shengduo Liu[1], Xuanhe Zhao[1,3]

1. Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139, USA.
2. Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139, USA.
3. Department of Civil and Environmental Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139, USA

Science Robotics 4, eaax7329 (2019) https://doi.org/10.1126/scirobotics.aax7329 last accessed 23.4.20

COLLABORATOR UPDATE

PSQM

The final stages of PSQM are pretty intense, reflecting on all that has been achieved and putting together a portfolio of evidence of impact. The award event is a great celebration of the achievement of the subject leaders who have led the yearlong process to evaluate and improve all aspects of science provision in their schools. Following this year's York event, where PSTT Fellow and Area Mentor Michele Grimshaw presented the certificates with Sir John Holman, the PSQM team caught up with some of the subject leaders to talk about their experiences of the programme, and the impact it has had in their schools, and on them. You can read two of the case studies on the following pages.

What is PSQM?

PSQM is a yearlong CPD programme that helps schools to achieve a quality mark for science. It focuses on developing effective, confident science leadership for whole school impact on science teaching and learning.

Why PSQM?

- PSQM provides a framework for improvement and development in science leadership, teaching and learning, whatever the school's starting point.
- PSQM is a community: of subject leaders meeting together locally with an expert hub leader for training and support; of schools across the country sharing expertise, challenges and successes; and of organisations and individuals providing great support for primary science.
- PSQM makes a difference to the profile and quality of science in primary schools.
- PSQM celebrates the impact of great science leadership.

How does PSQM work?

There are three different Primary Science Quality Marks to ensure that all schools can achieve the accreditation. Subject leaders from participating schools attend training throughout the year. With their hub leader's support and guidance, they:

1. audit current provision for science;
2. agree which is the appropriate quality mark to aim for;
3. construct an action plan to meet the thirteen criteria by the end of the year;
4. implement the plan and evaluate the impact on science teaching and learning;
5. compile a reflective submission to demonstrate how the criteria have been met.

The criteria are differentiated for each Primary Science Quality Mark to ensure that there is appropriate challenge and development for all schools, whatever their starting point. Over 60% of schools begin with PSQM, but for some schools, where effective leadership is already embedded, the other quality marks provide the right development goals. They cover all aspects of science provision:

- Science Leadership - vision and value, development goals, monitoring and professional development for subject leadership;
- Science Teaching - CPD, teaching strategies, resources;
- Science Learning - science enquiry, assessment, science capital;
- Wider Opportunities – linking science with other subjects and whole school initiatives, curriculum enrichment.

PSQM
Primary Science Quality Mark®
Valid 2019-2022
PSQM

CASE STUDY

Sacred Heart Catholic Voluntary Academy, Sheffield

The subject leader is **Agnieszka Barden**, an experienced teacher who began her career in Poland, and has had responsibility for science leadership for the last four years. Sacred Heart has 210 pupils and is part of a 3 school Multi Academy Trust. She is 'a passionate enthusiast for science'.

Why PSQM?

Agnieska is a great advocate of the PSQM process, initially leading her school to a Bronze PSQM, then re-accrediting soon after to embed and grow the changes made to science teaching and learning and achieve PSQM Gilt.

How has PSQM changed science at Sacred Heart?

It has helped raise the profile of science in school beyond recognition, radically altering the way staff and children think about science.

As a result of increased CPD opportunities through PSQM staff feel empowered. They have plenty of creative ideas to develop their practice and the enthusiasm generated transfers directly into the rich learning experiences teachers plan for their classes. Staff teach outdoor science lessons and use different stimuli to start lessons.

There are science displays in every classroom, which include key vocabulary. Displays also include questions, to encourage the children to investigate and explore further.

During Science Week all the children go out on science visits and all the parents and carers are invited into school for a Science Morning. This is a very exciting time and is very popular with parents, carers and grandparents alike.

Children are encouraged to see themselves not only as scientists, but also as global citizens. They discuss and debate, considering global issues as well as those more local to them. They are curious and have a 'thirst for knowledge', which the enriched science curriculum satisfies. The children now talk enthusiastically about science and it is a favourite subject for many of the children.

PQSM has enabled Sacred Heart to be more outward-looking and approach other STEM subjects with the same enthusiasm.

How has PSQM changed Agnieska?

Agnieska has grown massively in confidence through her extended contact with the PSQM process. She has taken great personal satisfaction in seeing – and celebrating – real quality in the science teaching and learning across Sacred Heart, and evaluating the embedded, sustained impact of the many changes to practice that she has led. She is now supporting teachers in other schools and has published in a science education journal and presented at CPD events.

Agnieska reports that, although very challenging, she has thoroughly enjoyed the PSQM process both times round!

"We are incredibly proud of Agnieszka and what she has helped the school to achieve."
– Head teacher

PSQM
Primary Science Quality Mark®
Valid 2019-2022
PSQM

CASE STUDY

Western Primary School, Harrogate

Western Primary School
CREATING SUCCESS STORIES

The subject leader is **Clare Howes**, who has led science for the last three years. Western is part of a Multi Academy Trust with twelve other schools. There are 460 children in school, and the proportion of disadvantaged pupils or pupils with SEN and/or disabilities is below that seen nationally.

Why PSQM?

Clare found out about PSQM through Facebook and persuaded her head teacher to apply, recognising that the process would provide a structure to audit established practice and, with the supportive guidance of a PSQM hub leader, to develop subject leadership, teaching, learning and wider opportunities.

How has PSQM changed science at Western?

All staff were involved in establishing a shared science vision which set the intent for science across school. The profile of science has been raised to its rightful position as a core subject alongside English and maths. Teachers are now enthusiastic about science and are more likely to ask questions relating to science and share their science 'wow' moments.

More time is now being allocated to science lessons. Science has become cross-curricular and extra-curricular, more practical and more child-led. Children are enthused and excited by their science learning and are keen to take their learning beyond the classroom.

Monitoring of science is now a developmental process, involving all staff plus pupil staff reps.

Resources have been upgraded and teachers are grateful to have equipment in school which are now well organised and more clearly labelled. They are also aware of online support that they can take full advantage of to further develop their own subject knowledge.

How has PSQM changed Clare?

As a result of the developments instigated as part the PSQM process, Western was invited to create a new science learning hub across the MAT and Clare is now at the forefront of primary science teaching and learning across the Red Kite Learning Trust.

She is a passionate advocate for PSQM, admitting that it was hard work, but a very rewarding experience. Her head teacher backs up Clare's assertion that PSQM has benefited children's learning and positively influenced their futures

"Science is a globally important discipline which holds the answers to so many of the world's problems and, as such, it needs to be a fundamental aspect of a school's curriculum. Our determination has always been to engender in our children a sense of excitement and wonder about the world of science and to develop them as curious, resilient and scientific learners. PSQM helped to make this happen; highly recommended."
- Head teacher

"We are very proud of our PSQM because it means that everyone can see how great science is at our school!"
- Year 5 pupil

PROJECT UPDATE

The Big Jurassic Classroom

The Primary Science Teaching Trust has worked with the Jurassic Coast Trust since 2014, culminating in the production of The Big Jurassic Classroom book. This free to download book brings together resources and information to show teachers how they can use their local environments to inspire interest in the UK's geological history. Compiled by PSTT Fellow and Area Mentor Carol Sampey, the book includes exciting activities for learning about rocks, fossils and evolution.

All the reproducible resources in the book are available at full size in a separate resource pack, also free to download (**click here**).

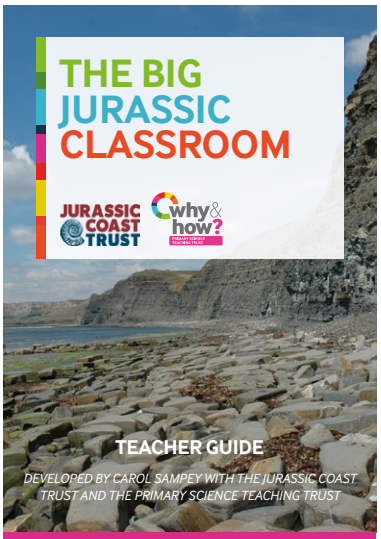
In addition to the book and resource pack, all the materials developed in the initial phase of the collaboration with the Jurassic Coast Trust are available on the Big Jurassic Classroom webpage (**click here**). These include:

Teacher Guides which explain:

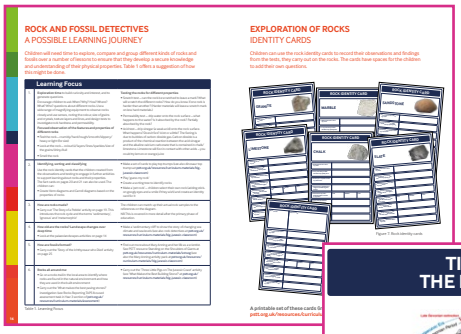
- the appropriate age range for the activities
- subjects and topics covered
- resources needed
- what the activity is about

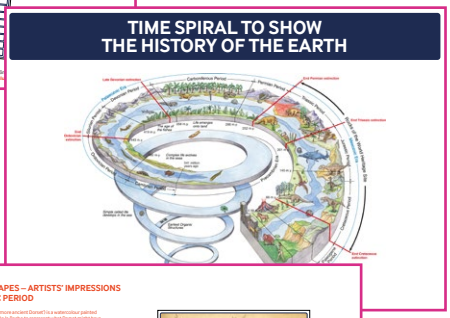
Activity Packs which provide:

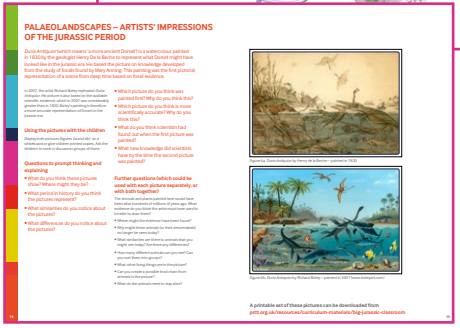
- images
- worksheets
- instructions for carrying out the activities



Click to download book







Carol Sampey,
PSTT Fellow and Area Mentor

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KEY DATES

Great Science Share for Schools

16th June 2020

#GreatSciShare

Are you registered for the Great Science Share for Schools?

Over 100,000 young people involved so far with a staggering 63,614 from 11 countries in 2019. Will you be involved this year?

The Great Science Share for Schools is a national campaign to inspire young people into science and engineering by sharing their scientific questions. You'll benefit from taking part by:

- encouraging young people to communicate their scientific questions and investigations with new audiences
- improving teacher confidence in teaching children to think and work scientifically
- raising the profile of school science, improving the science capital of children and families

Find out more **here**, or by turning to **page 22** of this newsletter.

Get connected and use the hashtag #GreatSciShare

Twitter: **@GreatSciShare**
Email: **greatscishare@manchester.ac.uk**

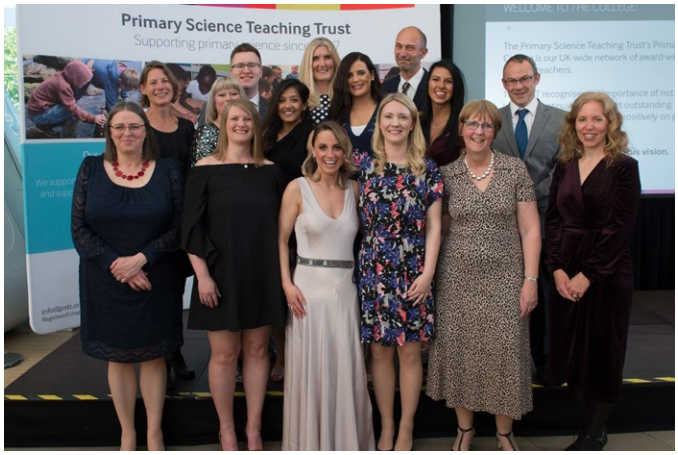
Primary Science Teacher Award Deadline

8th January 2021

Nominations are open via the **PSTT website**

Do you know an outstanding primary science teacher?

These awards celebrate amazing primary science teaching across the UK, recognising talented teachers in early years, Key Stage 1 and Key Stage 2. Teachers who win this award are not only judged to be outstanding practitioners in their own classrooms, they also support and develop colleagues in their own schools and others either locally, regionally or nationally. Award-winning teachers are also innovative, creative, enthusiastic and will have significantly raised the profile of science in their own schools and beyond.



sharing
&learning

excitement
&exploration

discovery
&delight

investigating
&questioning

www.pstt.org.uk

The Primary Science Teaching Trust (formerly the AstraZeneca Science Teaching Trust) was fully endowed with a grant from AstraZeneca PLC

why & how?
PRIMARY SCIENCE TEACHING TRUST

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