



Why & How?

Spring 2022: Issue 14

Magazine

FREE from PSTT:
UK Wildlife resources

Introducing 8 new
PSTT College Fellows:
Read all about them and discover
new ideas for primary science

Find resources for:
**Learning about
Biodiversity**

Supporting excellent teaching and learning in primary science
Why & How? is the magazine of the Primary Science Teaching Trust

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PSTT recommends that a full risk assessment is carried out before undertaking in the classroom any of the practical investigations and activities contained in this publication.

Why & How? is the brand name of the Primary Science Teaching Trust

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Welcome

Welcome to the 14th issue of *Why and How?*, the Primary Science Teaching Trust's termly magazine. *Why and How?* is for anyone who has an interest in primary science. Our magazine offers free resources to support teaching and learning, news from the PSTT and updates from our collaborations with other organisations. We value feedback from our readers, so please do continue to keep us posted about what you find most useful and interesting in our magazine.

Our **climate science** section shares details of the free to access recorded sessions from our Primary Climate Science Symposium, hosted in November in parallel with COP26. These recordings include events for use in the classroom, and a wide range of teacher CPD sessions. Also in climate science, we share a wealth of suggestions that support teaching and learning about biodiversity, including resources that particularly focus on helping children maintain a positive outlook.

This term's **picture for talk** is all about the properties of ice and how people can keep warm in an igloo. Through thinking and talking, children will engage with ideas about thermal insulation as well as learn about how temporary ice villages are built and used. Our **free resources** section brings you the newest addition to our collection, Wildlife UK. These picture-based resources have been developed in collaboration with The Nature Collection and we are very grateful to Susanna Ramsey for the use of her beautiful images. The resources are suitable for early years through to the end of primary. They encourage children to talk, think and reason as well as to develop knowledge and understanding about wildlife in the UK.

We have a brand new regular section, **Explorify**, where we will share news and latest developments. In this issue, we introduce our Explorify Engagement Leader team: four PSTT Fellows who are already creating new activities and leading dissemination events. Robin James then explores some of the background to Explorify, and describes why it works.

Continuing the theme of UK wildlife, this issue's **'I bet you didn't know'** article discusses research into mammals and whiskers. At the end you will find details of how schools can take part in the Royal Society's new 'Whiskers research project' through accessing a partnership grant.

Eight new PSTT College Fellows share their best ideas for improving primary science in **college snapshots**. Our **collaborator update** shares reflections from PSQM about the past year, with plans and hopes for the forthcoming year, and we also highlight the two previous issues of the Journal of Emergent Science.

In **wider collaborations**, the Royal Society of Chemistry (RSC) outlines their support for primary schools, including their new bespoke primary website, Steps Into Science. They share details of how teachers, including PSTT Fellow Caroline Skerry, are using these resources. We are delighted to be working closely with the RSC, and very pleased that they are a valued endorser of the Primary Science Teacher Awards.

Please do pass the magazine on to anyone who has an interest in primary science education.



Martin Pollard
Chief Executive Officer



Dr. Sophie Franklin
Research Director



Peter Sainsbury
Cluster Director



Ali Eley
Outreach Director



Sue Martin
Programme Director

News

Farewell message from Prof. Dudley Shallcross



It has been an amazing 12 years since I took over as Director of the then AZSTT.

In this time, we have established the College of Fellows, changed our name, developed the Regional Mentor, Area Mentor and Cluster

Programmes and the myriad projects of Fellows, some with stakeholders, published some amazing resources and held two highly successful international conferences. I am immensely grateful to the Trust for the opportunity to lead and develop the strategy throughout this time. It is the right time for me to step away from this leadership role and I wish Martin Pollard, his team, the College and stakeholders every success. I have no doubt that the PSTT will go from strength to strength, and I look forward to continuing to work with Fellows on projects such as ‘I bet you didn’t know...’. It remains for me to thank everyone who has supported me these past 12 years. It would be too long a list to name

everyone, but if I may single out two people, without whose support none of the achievements would have been possible: Dr. Mike Rance MBE, former chair of Trustees, and Kathy Schofield, the first college director. Onwards and upwards, PSTT.

The PSTT is extremely grateful for the contribution Dudley has made during his tenure of the Trust and wish him well in his future endeavours. Anyone wishing mark Dudley’s retirement from the CEO role is asked not to send cards or gifts. You may wish to consider making a donation to a charity very close to his heart, The Children’s Hospice South West, by following the [link](#).

Meet the PSTT’s new CEO



The PSTT is pleased to welcome Martin Pollard as our new Chief Executive Officer. He takes up the post on 1 February, and succeeds Professor Dudley Shallcross, who has led the PSTT through a period of great innovation and expansion since 2010.

Martin has over 20 years of experience in a variety of educational roles, as a teacher, trainer and charity professional. He was Chief Executive of the Welsh Centre for International Affairs and, most recently, the Learned Society of Wales.

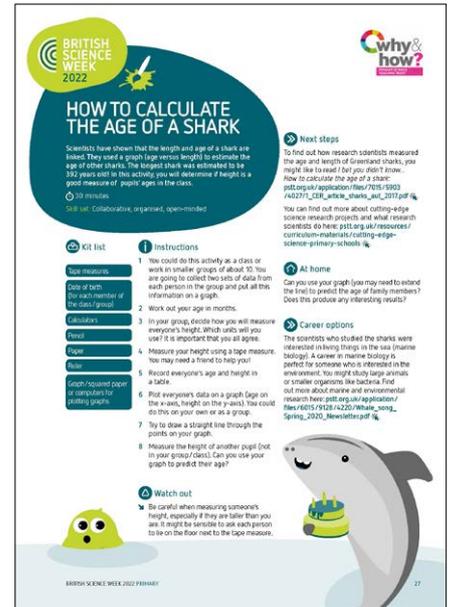
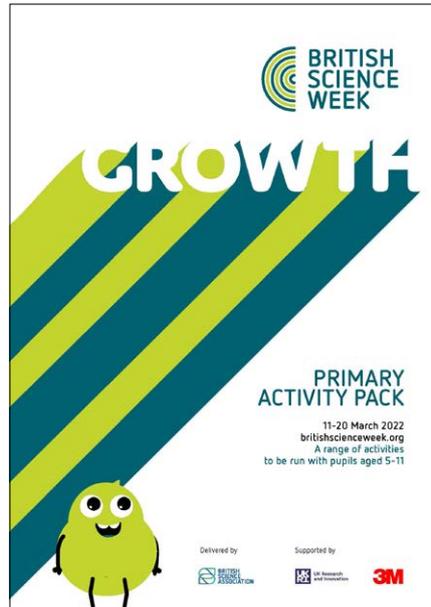
Martin said: “I’m delighted to be joining PSTT as it continues to flourish. We have a fantastic team of staff, Fellows and College mentors dedicated to excellent primary science education across the UK, and I look forward to playing my part in this mission. I’m grateful to Dudley Shallcross for leading the transformation of PSTT over the past 12 years, and I wish him all the best in his future endeavours.”



British Science Week Activity Packs

British Science Week is a 10-day celebration of science, technology, engineering and maths that will take place between 11-20 March 2022. Free packs on this year's theme of 'Growth', supporting early years through to secondary level, are available from the British Science Week website [here](https://www.britischescienceweek.org).

The PSTT is delighted to have contributed an activity to the Primary Activity Pack, 'How to calculate the age of a shark'.



United Nations International Year of Glass 2022

To celebrate the essential role that glass will continue to have in society, the United Nations declared 2022 the International Year of Glass (IYoG) and an international launch event is planned for February.

The PSTT is delighted to be collaborating with the Worshipful Company of Glass Sellers to create new resources that champion 'bringing glass back into the primary classroom'. We are currently planning a free science activity resource pack, a design competition that links science and art, and further opportunities for children to learn more about glass as a sustainable material for the future.

Keep a close eye on our social media and news items for launch details, and be sure to sign up to our contact list, via the PSTT website, to hear more about the opportunities on offer as they arise.





New primary science awards from the Royal Society of Chemistry



We are delighted to congratulate the first group of winners of the RSC education awards that are specifically given for primary school science. Click on the award links to find out more.

The 2021 winner of the **Team Prize for Excellence in Primary Education:**

Stalham Infant and Junior Schools, awarded for the development of an engaging curriculum and teaching strategies, promoting a love of science and effective science learning amongst children, families and staff.

The 2021 winner of the **Excellence in Primary Education Prize:**

Nicky Waller, Centre for Industry Education Collaboration, University of York, awarded for sustained

contributions to the professional development of primary teachers in the teaching of science.

The 2021 winner of the Early Career Prize for **Excellence in Primary Education:**

Joshua Piggott, St Nicholas' C of E First School, awarded for dedication, enthusiasm and effectiveness in the delivery of quality-first science pedagogy for children aged 4–9, while breaking down the stereotypes of the classic portrayal of a scientist.

The Heart of the Matter

In a new BBC podcast, PSTT Fellow Hannah Osueke talks about the cardiovascular system, its anatomy, functions, how to keep it healthy, how to mend it and the early pioneers of heart surgery.

Her 'Teach Me a Lesson with Greg James and Bella Mackie' is engaging, and full of interesting and surprising facts. The podcast gives useful background knowledge for teachers, but note that it is intended for adults as some of the content is not suitable for children. Listen on BBC Sounds [here](#).



Climate science

Primary Climate Science Symposium

In parallel with the United Nations Climate Change Conference of the Parties (COP26), held in Glasgow in November 2021, the PSTT hosted an online Primary Climate Science Symposium (PCSS) for primary teachers and children.

We had fantastic engagement, with the live classroom events reaching over 10,000 children and the CPD sessions being attended by over 200 teachers. The GOOD NEWS is that the sessions have been recorded, so if you weren't able to attend at the time, the recordings are FREELY downloadable and can be accessed [here](#).

Available recordings for using in the classroom

Threats to Nature

with Amy Ball (WWF-UK)



Length: 56 mins

Age: 7-12

SYNOPSIS

This presentation explains what is meant by climate, and outlines the characteristics of different kinds of climate. Amy poses questions to **encourage the children to think** and to observe the images closely. She explores the impact of climate change on different habitats and nature, illustrating the ideas with **demonstrations** and **engaging visuals**. Children are encouraged to focus on realistic changes they can make to their own lifestyles. The presentation finishes with a fun and thought-provoking quiz.

Can we stop climate change? Yes. How do we do this?

with Professor Dudley Shallcross (University of Bristol)



Length: 53 mins

Age: 8-12

SYNOPSIS

This session starts by using questions, images and scenarios to **stimulate children** to think about the difference between climate and weather. Dudley presents key facts, real data and visuals to **build the children's understanding** of why carbon dioxide in the atmosphere can be a problem and why the levels are increasing. The second part is solution focussed, encouraging the children to **think globally** but also to consider what they could **change** in their own lifestyles.

School of fish: upcycle a sculpture shoal

with Alistair Lambert (Alistair Lambert Sculpture)



Length: 63 mins

Age: 4-11

SYNOPSIS

In this practical session, Alistair shows us how, instead of throwing away or recycling used Tetra Pak cartons, we can turn them into **beautiful sculptures**. As he demonstrates how to deconstruct the carton, he highlights concepts about **properties and uses of materials**. He then encourages children to look at pictures of fish and identify their **key features** before drawing an outline onto the Tetra Pak and cutting it out. The session progresses to making a more complex sculpture by creating a **fish skeleton**. At the end, Alistair suggests hanging each fish made by the children to make a display or even a mobile.

These classroom sessions would also be suitable for early secondary aged children so please do share with secondary schools in your networks.



Available recordings for teacher CPD

Making climate conversations more accessible and diverse

with Joycelyn Longdon (Climate in Colour)



Length: 54 mins

This keynote talk outlines the **critical role of education** in addressing the climate crisis. Using clear and real examples, Joycelyn explains some of the central issues, e.g. **environmental injustice** and its impact on vulnerable communities, and wealthier nations benefitting from high carbon activity in less developed nations. She outlines a **solution-focussed** approach to climate justice, and explores how this needs to be underpinned by **terminology and language** that is universally understood and agreed.

Empowering students through co-design

with Joe Boyle, Kate Kirkwood and Laura Copley (RSPB Scotland)



Length: 59 mins

This session starts by exploring what it means for children to **participate**, and how they can be supported to become more informed agents of change. Kate outlines the value of this for **collaborative work**, with each other and with other organisations. In the second section, Joe shares details of how school children took part in a **co-designed project** to engage with seabirds and biosecurity. This project encompassed the different languages, cultures, industries and wildlife across Scotland, with a range of outputs, e.g. games, songs, posters and activities. Finally Laura shares details of the scheme '**Wild Challenge**' and how it encourages children to engage with nature, **build resilience** and work collaboratively. Details of how to sign up for the scheme are included and there is also a **family** version of the challenge.

Geological solutions to the climate crisis followed by 'Explore: urban nature' – asking scientific questions

with Rose Want (Geological Society, London) and Laura Soul (Natural History Museum)



Length: 59 mins

The first half of this session outlines how **learning about rocks** is a helpful basis for children to understand some of the key scientific facts about climate science. Rose uses graphical data to share how fluctuations in **global temperatures** are reflected in rock records. She shares possible **geological solutions** to addressing the current crisis, e.g. injecting carbon dioxide back into the ground. **Practical ideas** for investigations and models to use in the classroom are shared, with an emphasis on finding out about how many things we use every day have come from rocks. In the second part of the session, Laura outlines the project 'Explore: urban nature' which focuses on the importance of **biodiversity**. Children taking part **work scientifically** and focus on issues in their local area, and the project helps give them the **agency** to be part of the solution. She suggests that a really good starting point is to **go outdoors** to observe and ask questions, (e.g. How many different types of tree can we see?) before looking more closely to **identify the impact** of human activity.



Available recordings for teacher CPD

Why climate psychology is essential in climate education and what to do about it

with Jo McAndrews and Caroline Hickman (Climate Psychology Alliance)



Length: 60 mins

Caroline starts by outlining that children feel anxiety or emotion about the **planet** because they **care**, and that this should be seen as an emotionally healthy response. She explains how **eco-anxiety** in children can become severe and constitute a mental health issue. She frames her session in terms of moving this eco-anxiety in children to **eco-empathy** by supporting them to face difficult truths. Jo builds on this idea and highlights how important it is for children to have **adults 'on their side'** and who understand their experience and concerns. This role will often fall to teachers which, as Jo points out, has implications for **teacher development** and training so that they are equipped to be **honest** with children and to address their concerns in small steps. At the end, Jo and Caroline talk about how encouraging children to interact at a personal level can actually result in them either feeling inadequate, and/or leave them thinking that they are personally responsible for saving the planet. They suggest that teachers could encourage children to work with others as part of a **community**.

Combatting climate change by eating seasonally and using digital literacy to explore the climate crisis

with Michele Grimshaw (PSTT) and Paul Tyler (Kirkhill Primary School and PSTT Fellow)



Length: 66 mins

The first part of this session explores **food waste**. Michele shares some facts about how much food is wasted in the UK and globally, how this happens throughout the food supply chain, and the wider **environmental impact** of reducing this waste. She offers lots of **practical suggestions** for classroom activities to support children to understand the impact of their own actions. In the second half of the session, Paul puts forward the case for using film to increase children's understanding and engagement with climate change. He suggests that it is a **powerful medium** for children to develop the **emotional connection** to the Earth that is necessary to **inspire action**. He describes the potential of an animated story with no dialogue for engaging children with issues such as climate justice. Links to all the film clips used are shared at the end.

Panel discussion: greening your curriculum and school systems

with Elizabeth Chambers (The Royal Society), Amy Ball (WWF-UK), Olivia Sweeney (Resource Futures) and Paul Tyler (Kirkhill Primary School and PSTT Fellow)



Length: 63 mins

Four presenters share **resources, projects and ideas** to support schools with climate change education and related issues through **building whole school approaches**. Suggestions are given for involving the wider school community and encouraging children to focus on what they can achieve at a local level. The panel then responds to the questions submitted by teachers attending the event; questions were selected on the basis of their relevance to all, and the panel's answers included many **specific examples** of what schools and action groups are currently doing.



Available recordings for teacher CPD

I bet you didn't know...
cutting-edge climate
science research projects
can be shared with
primary children

with Alison Trew (PSTT)



Length: 43 mins

Alison Trew presents a selection of PSTT's 'I bet you didn't know...' resources that relate to climate science. These resources link **real, cutting-edge science** research to primary science curriculum topics. They include an article **explaining** what the researchers did and what they found out, and each of these articles has an accompanying powerpoint presentation for teachers to use with children. These slideshows offer **suggestions for enquiry** that can be done in the classroom, giving children the opportunity to mimic real science research as well as develop their scientific **vocabulary**.

Teachmeet

THE
ROYAL
SOCIETY



ZSL | LET'S WORK
FOR WILDLIFE

Length: 60 mins

A sharing of ideas and resources from:

- The Royal Society
- The Zoological Society of London
- The Primary Science Capital Teaching Approach handbook
- The RSPB
- Weather data
- 'Live for the planet' leaflet
- 'How we can connect with climate change' powerpoint

➔ Please click [here](#) to access any of the recordings

We are extremely grateful that this event was supported by many other organisations and we thank them all for their time and commitment to the event.

Climate science

Supporting resources for teaching and learning about biodiversity



What is biodiversity?

Biodiversity is the variety of life on Earth. We use the term to mean all the living things in the natural world around us, from the simplest, single celled bacteria to the most complex plants and animals. Different organisms live alongside and interact with other organisms: this interdependent arrangement is called an ecosystem. Ecosystems can be small, like a hedgerow, or huge, like a rainforest or part of an ocean. If the balance in an ecosystem is upset by

a natural disaster (like a fire or flood) or by human activity (like a building development or chemical pollution) the whole ecosystem is affected. This could be serious enough for the whole ecosystem to collapse, and for particular species of organism to die, and in severe situations, to become extinct.

Find out more with this three-minute video: **What is Biodiversity?** narrated by Sir David Attenborough. To help

children visualise how much variety of life there could be in a small space, watch **Biocubes – Exploring Diversity**. This three-minute video introduces the Biocube – a fun and relatable way for children to measure how many living things there are in a cubic foot, and to find out how they can use this to compare what they find in different habitats. There are additional supporting resources, teacher guides and videos for anyone wanting to take these ideas further.

Why is biodiversity important?

Loss of biodiversity is a threat to human existence. The interactions between different plants, fungi and animals are not just essential for the food we eat, but for ensuring that we have oxygen in the air, clean water and medicines. If insects disappear, we would lose the pollinators that are crucial for plant life cycles to continue, resulting in no food. Every time a rainforest is destroyed, not only is the biodiversity of that ecosystem lost, but future events that further destroy biodiversity are more likely to happen. For example, without the trees in a rainforest, the soil becomes unstable, increasing the possibility of landslides.

Find out more with this six-minute video from The Royal Society, [Why do we need nature?](#) narrated by Sir David Attenborough.

Have a look at the wealth of resources to support learning about biodiversity from the [Royal Society](#).



How can we develop children’s understanding of biodiversity and why it is important?

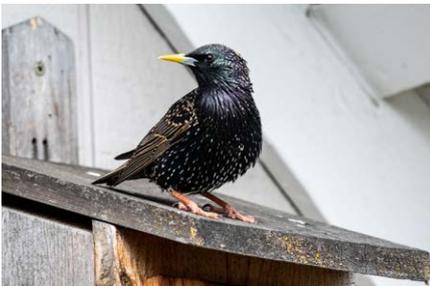
Coral reefs are thought to be the most biologically diverse ecosystems on Earth. [Seaview Science: how diverse is the life of the coral reef?](#) - a one minute video from [Encounter Edu](#) – shows, in glorious colour, a huge number of species co-existing, and how the survival of each species depends on all the others.

Watch [A Plastic Ocean](#). This three-minute video explains the problem of plastics in the ocean and the impact they have on ocean ecosystems and biodiversity. The video gives children positive messages about practical things they can do to help.



Maintaining a positive outlook – what can teachers, children and school communities do?

Read about the Natural History Museum's **Urban Nature Project**. Maybe you could join in, or start a similar project of your own? **The Natural History Museum UK Biodiversity webpage** has lots of other resources and ideas to encourage schools to embark on projects or take part in citizen science initiatives.



Make a Biodiversity Action Plan with RSPB's resource to help schools increase the biodiversity in their own grounds. The website offers other ideas for related projects, including the **Wild Challenge Awards** and **Gardening for Wildlife**.



Find out about real world projects that have successfully reversed biodiversity loss. **How Wolves Change Rivers** is a five-minute video that explains how re-introducing grey wolves into Yellowstone Park transformed not only the park's ecosystem but also its physical geography.



Find out more about the World Wildlife Fund's resource, **Learn to Love Nature**, that offers engaging activities and resources to support children to connect with nature and learn about Earth's biodiversity.



Explore the **Eyewitness Channel on YouTube**, which has a wealth of short videos to develop understanding of living things and how they depend on each other for survival.



Take a look at some of the PSTT's **I Bet You Didn't Know?** resources as many of these relate to biodiversity. Why not get started with this one about **Trophic Cascades?**

Visit the **Incredible Oceans** website. Their '**Ocean Geekery: life below water**' page houses 30 videos covering different aspects of life in the sea and rivers, including stories of conservation projects that address ocean biodiversity. Secondary colleagues might be interested in their sister website, **Siren**, which creates a space for young people to imagine a better future.



Please note that the Primary Science Teaching Trust (PSTT) does not endorse materials from other organisations with whom we do not have a specific agreement. Links shared in this article are from recommendations from PSTT College Fellows and from organisations with which the PSTT has worked, and inclusion does not confer any endorsement by PSTT. As with all resources, the PSTT recommends that teachers look at them in full and make their own decision about the suitability for using them with children.

Free resources

Picture for talk



Click to download image

Figure 1

A picture can be a very good stimulus for children to engage in effective talk in science.

Using pictures is an inclusive approach which facilitates high levels of participation. Pictures can also be used as a starting point for inquiry. The discussions the children have will generate questions that they want to investigate.

Asking the children carefully chosen questions about the picture will support them with learning to:

- Construct explanations and link their ideas with evidence
- Make confident challenges to the ideas of others
- Explore scientific terminology and use it with genuine understanding

Pictures for talk in science activities are designed to be very open ended and usable with children of any age. The activities can be done as a quick ten minute starter, or extended into a longer and more in-depth lesson.



What to do

Download the image in fig.1 by following the link and either display on a whiteboard or give out printed copies. Ask the children to discuss, in groups of three, the following questions:

What are igloos made from?

Where do you think these igloos have been built?

Why do you think this?

Do you think anyone lives in them?

Explain your ideas

The igloos are situated on Lake Shikaribetsu, a freshwater lake in the Daisetsuzan National Park, Japan. This is located at an altitude of 810m and is one of Japan's coldest regions. The lake generally freezes between December and May. The village that is built, and usually open for use from January to March, includes the igloo lodges that can be used overnight, a concert hall, chapel and bar, all made entirely from ice and snow.

From May, pleasure boats are used on the lake.

Other questions to generate and promote thinking and explaining

- Why does the village have to be rebuilt each year?
- What would you expect to happen to the igloos during the different seasons?
- What changes might occur as the temperature increases? (Think about seasonal changes, not just changes of state.) Where does the heat come from to make temperatures rise?



[Click to download image](#)

Figure 2

- How might climate change affect the village?
- What would be the highest temperature the ice and snow can reach before starting to melt?
- If you were at that frozen lake, what would you wear and why?
- How does clothing keep us warm?

A common misconception is that clothing generates heat, which is not the case. Encourage children to think about their body heat (internally, around 37°C) and how this can be trapped inside clothing to keep the body warm. Clothing acts as an insulator – a material that does not allow heat to pass through it easily.

Snow and ice also act as insulation. So if there is warmth inside an igloo, it can be retained within the building. Warmth might be provided by various heat sources and from bodies that stay inside. There may be some melting of the ice on the inside of

the walls if temperatures rise above 0°C, but the thick ice will take a long time to melt, as it has good insulating properties. 0°C is a lot warmer than the outside temperature throughout the winter and the igloos will also protect people from winds, which can be even colder.

Download the image in fig. 2 and ask the children to discuss:

- How do you think people can survive in these temperatures and stay overnight in the buildings?
- What materials were chosen for the seat cushions? Why do you think the cushions might be needed?
- What materials would you choose for cushions and other soft furnishings in an igloo? Why would you choose these?

Free resources

UK Wildlife



NEW! Resources for learning about animals and plants in the context of UK wildlife.

We have been delighted to work with the **Nature Collection** to create these resources and we are extremely grateful to Susanna Ramsey for her generous donation of their original images to the PSTT.

[Click Here](#) to access the resources.

Our brand new wildlife resources are designed to:

- Raise children's awareness of the wide variety of animals, plants and fungi that can be found in the UK
- Support the development of children's observational skills
- Encourage children's use of correct scientific vocabulary
- Increase scientific literacy through promoting paired or group talk

These resources are suitable for using across the primary age range. They include games, card sorts,

paired pictures for talk, annotated slideshows, and odd one out activities.

They can be used before taking children outside to explore their natural environment, as a follow-on activity after going outside, or as stand-alone activities. All the resources include supporting background knowledge for teachers and links to other related resources.

The resources are organised in three sections.

1. Animals

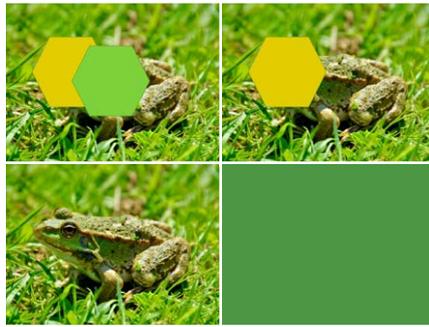
The animal resources are ideal for developing children’s subject knowledge and learning the names and features of animals typically found in parks, gardens, fields and hedgerows in the United Kingdom. The activities are interactive, fun and varied, and include opportunities to guess the animal in the picture as parts of it are gradually revealed, or to match picture halves to make a ‘wildlife face’.

Examples from the animal resources:

Who is hiding?



Which animal might be hiding behind these shapes?



The slides that follow take away a shape at a time to reveal the animal

Matching faces



Can the children find the pair to each picture to make a complete animal face and then can they find out what the animal is called?

2. Plants and Fungi

The plant and fungi resources support children to learn the names and features of **plants and fungi** and encourage them to spot them when they are in the outdoors. Children are encouraged to observe closely to choose an odd one out and to explain how they made their choice. The paired picture activities also encourage focussed observation.

Examples from the plant and fungi resources:

Paired pictures

What is the same and what is different?

horse chestnut (conkers) sweet chestnut

What is the same and what is different?

dandelion flower dandelion seeds

Questions to encourage children to observe closely and describe similarities and differences

3. Mammal Skulls and Teeth



This set of six slideshows encourage children to **think** about the links between structure and function and how particular **features** of animals enable them to **survive**. Each slideshow features one mammal (badger, deer, fox, hedgehog, rabbit, squirrel). Each starts with a series of questions (answers are also included) about the external features of the animal before moving on to consider the animal's skull and teeth in more detail. The slideshows can be used flexibly and the discussions with the children can be pitched as appropriate for their developmental stage.

Examples from the mammal skulls and teeth resources:



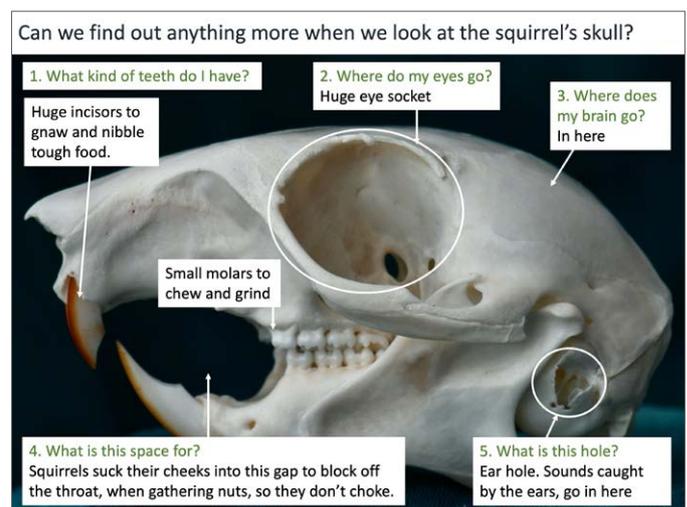
Questions to encourage the children to observe closely and to link the animal's features with how it survives



Answers on the next slide support the development of children's scientific thinking and understanding



Questions to encourage the children to observe closely and think about the structure and function of the animal's skull and teeth



Answers on the next slide support the development of children's scientific thinking and understanding

Acknowledgements
the Nature Collection



Susanna Ramsey from the Nature Collection has written a new blog piece for the Wow Science website. Click [here](#) to find out how you can make the most of children's fascination with bones and skulls, and how images can be used to show children some of the similarities and differences between humans and other mammals.



Explorify

Following the transfer of Explorify to the management of STEM Learning in partnership with the Primary Science Teaching Trust, we are delighted to welcome four new members of staff to the PSTT as Explorify Engagement Leaders.

PSTT Fellows Rebecca Ellis, Robin James, Jo Moore, and Stacey Reid will be responsible for developing new Explorify content, presenting Explorify workshops, and raising awareness of Explorify to teachers. Find out more about them here:

Rebecca Ellis



Rebecca Ellis has taught for 20 years in a 3 form entry junior school in Warwickshire and has two children. Prior to teaching, she gained a Biology degree from the University of Bristol and an Engineering doctorate from

the Water Sciences Institute, Cranfield University. Her motivation to teach comes from a desire to understand each individual child in her care so that she can creatively inspire them to love learning. During her 10 years leading science, highlights have included leading the school through PSQM and SSQM to achieve gold standard, organising family learning events and competitions (including supporting the organisation of the Warwick University Primary Science Fair) and being a student mentor and guest speaker for the University of Warwick. Rebecca was awarded the Primary Science Teacher of the Year in 2018 and since then has been part of the 'I bet you didn't know...' PSTT team who write articles and teacher guides about cutting-edge science for primary school children.

Rebecca believes that all teachers aspire to provide the best learning experiences so that their children show excellent progression in primary science. She is looking forward to using her experience to support her hard-working colleagues with easy to implement and purposeful ideas and strategies to develop and share Explorify more widely.

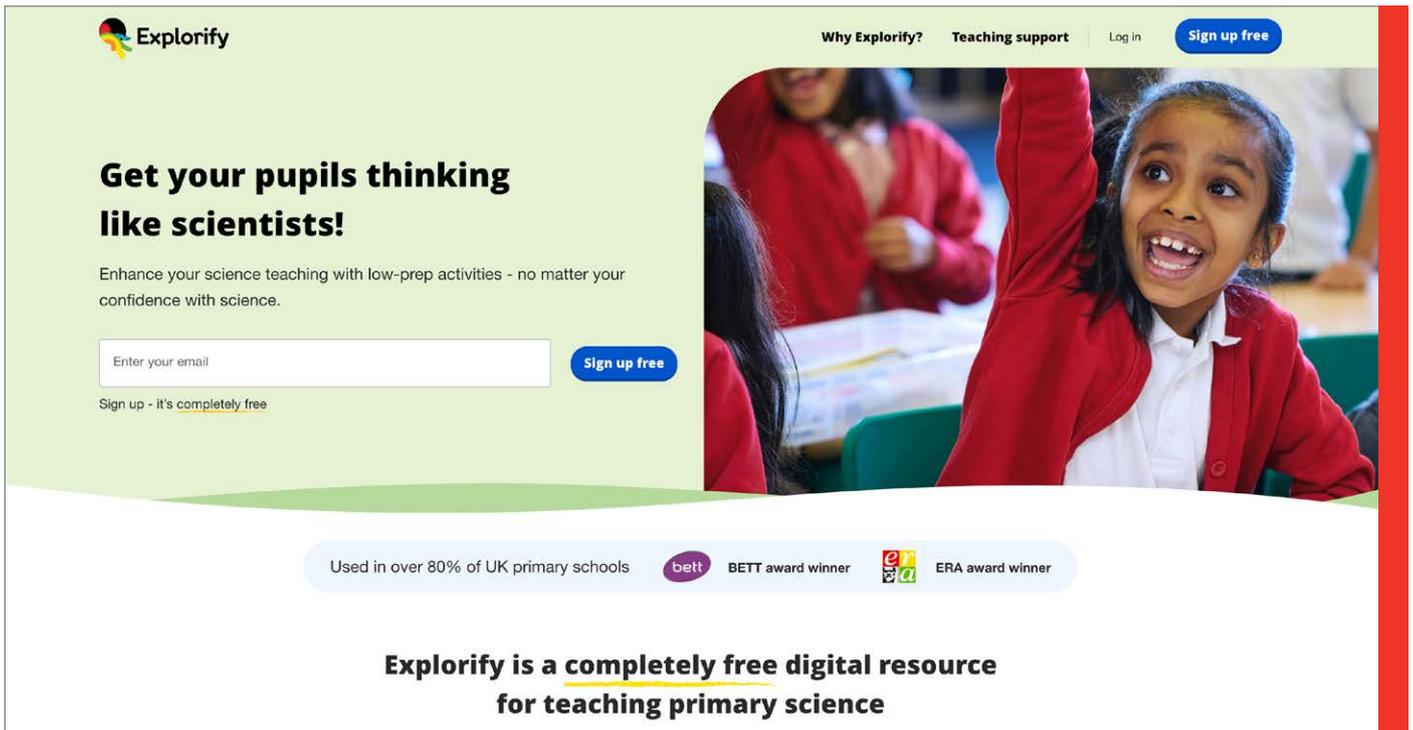
Robin James



Robin James became a primary teacher at 30 after working as a wine merchant, among several other things. He was drawn to the nurturing, creative, curious nature of the classroom and enjoys finding projects that make

learning that little bit more exciting. One of these, 'Racing Sand Yachts', was his second to be shortlisted for the Rolls-Royce Science Prize and led to him becoming a PSTT Fellow in 2013. Robin has since developed a technique called 'Stop! Watch!' that uses short, self-made films of children's practical work as an assessment tool and he was able to research the effectiveness of this for a Master's degree. A visit to CERN inspired another idea: the Hula-hoop Hundreds-and-thousands Hadron Collider (HHHC), which introduces young children to particle physics.

Robin is delighted to be joining the Explorify team. Explorify made a big splash in a short time because it's simple, dependable, and loaded with excellent resources: that's why teachers rate it so highly, Robin included, and he wants to innovate and develop it, yet keep its essential user-friendliness.



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Used in over 80% of UK primary schools  BETT award winner  ERA award winner

Explorify is a completely free digital resource for teaching primary science

Jo Moore



Jo Moore is very excited to be joining the Explorify team after 18 years of primary teaching. For the last eight years, Jo has been lucky enough to be a specialist science and computing teacher at Vittoria Primary School in

Islington. During that time, she has taught science across the school and supported teachers to build their skills and confidence. Prior to that, Jo was an Advanced Skills Teacher in Science, supporting teachers and Science Leads in other schools. Jo has lots of experience of teaching the English primary science curriculum and is keen to support new and more experienced teachers across the country, as well as Science Leads.

Recently, Jo has been part of the Primary Science Capital Teaching Approach research project and is eager to bring some of those ideas to Explorify. Jo has used Explorify regularly in the classroom, to develop children’s talk and higher order thinking skills, and is looking forward to contributing to such a great resource. Explorify has a great reach across primary schools, but this needs to be maintained and developed, and Jo looks forward to being part of this in the coming year.

Stacey Reid



Stacey Reid has been working in education for the past 15 years. In her previous role, Stacey was an Assistant Headteacher with the responsibility for curriculum, where she designed and created a bespoke curriculum. This

included creating cross-curricular science units of work and resources. Stacey is a PSTT Fellow and has trained science leaders and teachers on how to deliver best practice science within schools. She has also led a Science Cluster which helped to develop science across a number of schools and the local authority.

Stacey has a passion for science and delivering science that is practical, meaningful, and relevant to children, as well as ensuring that teachers feel confident and enthusiastic about science too. Stacey is very excited to take on the role of Explorify Engagement Leader and to work with this amazing team to develop Explorify further.



Explorify works! Here's why...

Robin James, Explorify Engagement Leader for the PSTT, explains:

You might already know what Explorify is, love it, and have tried it yourself with your children. But how do we know it works? What does the research tell us about the effectiveness of Explorify in classrooms since its launch in 2017?

Explorify engages all children, particularly at the start of lessons; it gets them talking and their minds 'ready to learn' with their discussions becoming more in-depth, coherent, and scientific as a result.¹ As there is usually no definite right answer, the fear of being wrong is reduced, hence a boost in pupil confidence and enjoyment of science learning has been reported¹ along with an increase in teacher confidence as well.²

Explorify is packed with 'engaging, creative science activities... designed to spark curiosity, discussion and debate'.² The design of the activities is underpinned by the findings and approaches from the **Thinking Doing Talking Science** project⁴ and its precursor, **Bright Ideas**. Both these projects recognised that children's natural curiosity about their world was being eroded through the primary school years, and as a result they developed strategies that promoted and encouraged higher order thinking through discussion.³

Almost all (98%) of teachers who have tried Explorify say they intend to continue using it.² For children and for teachers who might find science boring or scary, the Explorify approach has been shown to help.¹ The quality of the resources, accompanied by dependable, bitesize chunks of background science, has been greatly appreciated by busy teachers. Minimal or often no preparation is required and Explorify activities are found to be easy-to-find, plentiful and regularly refreshed, with most being possible to complete in under fifteen minutes.¹

Thinking Doing Talking Science and **Bright Ideas** were both original projects funded by the PSTT. The current strategic rollout of the Thinking Doing Talking Science CPD programme for teachers is supported by a grant from the PSTT to Science Oxford.

References and further reading

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I bet you didn't know

Why & How scientists measure mammals' whiskers



Dr. Alison Trew,
PSTT Website Resources
Developer and Area Mentor
E: alison.trew@pstt.org.uk

Did you know that most mammals have whiskers? Humans are one of the few types of mammals that do not have whiskers.



Figure 1. Types of whiskers. You can clearly see that the sea lion's whiskers are arranged in rows.

Little is known about how whiskers grow and how they work because few species have been studied. A group of biological scientists and engineers in the UK have been measuring the size and shape of mammalian whiskers to try and find out more (Figure 1).

What are whiskers for?

Whiskers are for touch sensing. Scientists think that whiskers are important for guiding movement from one place to another. Nocturnal, arboreal, and aquatic mammals tend

to have relatively long whiskers that are organised in rows and columns, which suggests that whiskers are important for helping a mammal to orient itself in dark, complex spaces. Mammals that are active during the day (and inactive or asleep at night), such as horses, tend to have fewer and less-organised whiskers. Whiskers could be important for searching for food and hunting. Seals that hunt fast-moving prey (fish) have more moveable whiskers than walruses that feed on slow-moving or stationary prey (such as clams and snails) at the bottom of shallow waters. However, some mammals

that hunt moving prey in the dark, such as whales and bats, can have very short whiskers or even no whiskers and rely on other senses to help them locate food (echolocation). We don't know why some mammals have whiskers and some do not. Whiskers are also thought to be important for messaging between mammals, for example to allow young mammals to keep close to their mother or to locate an opponent in a fight. Some mammals remove or shorten another's whiskers, for example a mother cat may trim her kittens' whiskers, perhaps to keep the kittens close to her.



What is known about whiskers?

Different mammals have different arrangements and numbers of whiskers (Figure 1). Most research on mammalian whiskers has been carried out on laboratory mice and rats, and mammals kept in zoos. Whiskers are thin, curved structures that are made of a substance called keratin (like human hair). They are always growing (just like hair). Studies have shown that mouse whiskers grow 1mm a day.

Most mammals' whiskers are round and smooth along their surface, except seal and sea lion whiskers, which are oval (perhaps to be more streamlined). Seal whiskers are also not smooth, but undulating (or wavy) along their surface, which is thought to help them sense better underwater.

Most whiskers are tapered, which means they are thinner nearer the tip than at the base. This means that whiskers are more bendy (flexible) towards the tip. Whiskers bend when they contact a surface. The bending is sensed by receptors in the skin, within the whisker follicle. The receptors send messages through nerves to the brain. The size and shape of the whisker will determine how bendy it is, and so the size and shape will affect the information that reaches the brain.

Questions to discuss with children

- What types of whiskers have you seen? Are they arranged in rows? What size, shape or colour are they?
- What do you think whiskers are for?
- Why do you think some animals have longer or shorter whiskers?
- Why do you think most research has been carried out on mammals in laboratories or zoos?

What did the scientists want to find out?

As few species of mammals have been studied, Dr Robyn Grant and her team wanted to measure the size and shape of whiskers in a wider variety of mammals. This will help them to find out what whiskers are for, how they work, and how they grow.

What did the scientists do?

Dr Robyn Grant and her team of scientists collected whiskers from 19 species of mammals from museum specimens. These included a fox, a hamster, a porcupine and a meerkat. The whiskers were plucked from each mammal and in total, 687 separate whiskers were collected. These whiskers were photo-scanned to create images of the whiskers. The image of each whisker was placed onto a Euler spiral to see if it fitted along the curve (Figure 2). The scientists observed, recorded and compared the curliness, the length, and the taper of the whiskers.

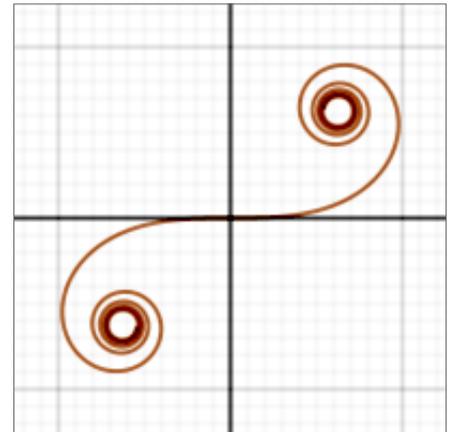


Figure 2. A Euler spiral is a curve that curves more as it gets longer. Also called *spiros*, *clothoids*, or *Cornu spirals*.

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What did they find out?

All the different types of mammals investigated had tapered whiskers that fitted on the outline of a Euler spiral. This might mean that a common ancestor (but now extinct) had similarly shaped whiskers.

Mammals that live in the sea have thicker, stiffer, more tapered whiskers than terrestrial and arboreal mammals. This means that aquatic mammals have specially shaped whiskers that reduce drag (as they are shorter) and can be positioned in the water without wobbling around (as they are stiffer).

Smaller mammals tend to have longer, thinner and more flexible whiskers than larger mammals.



Why is this research important?

To find out more about whiskers, scientists need an accurate way to measure the shape and the size of whiskers. The method the scientists used is quick and easy, and the Euler Spiral model could be a useful tool in helping scientists to compare the whiskers of a wider variety of mammals. Previous studies have compared whiskers to different shaped curves, but these have been difficult to use.

Knowing more about whiskers could help us improve the welfare of mammals in human-designed environments like zoos and natural habitats where human activity has disturbed the natural environment.

What next?

Further studies must include a wider variety of mammals. This will tell us more about how whiskers are used by different mammals in different habitats.

What could children investigate?

The Teacher Guide that accompanies this article describes investigations that children could carry out to find out more about the form and diversity of whiskers. Examples could include:

- What can you sense with your fingers?
- How are whiskers arranged in different mammals?

- Is the arrangement or number or length of whiskers related to the length of the snout?
- Do all cats (or another animal) have the same arrangement/length/number of whiskers?

Children could create a photo bank of different mammals to answer some of these questions and create graphs to show the relationship between snout length and features of whiskers.

Glossary

aquatic – relating to water - an aquatic animal lives in water for most or all its life

arboreal – relating to trees - an arboreal animal lives in trees for most or all its life

echolocation – a process for finding distant objects by means of sound waves that bounce back to the source

Euler spiral – a curve that curves more as it gets longer

mammal – a warm-blooded animal with a backbone that has hair or fur; females produce milk to feed their young and (typically) give birth to live young

nerves – bundles of fibres that carry messages to or from the brain or spinal cord

nocturnal – happening at night - a nocturnal animal is active during the night

prey – an animal that is hunted and killed by another for food

receptors – specialised cells that send messages when stimulated

species – a group of living things capable of breeding and producing young

taper – becoming thinner towards one end

terrestrial – on or relating to the earth - a terrestrial animal lives on the ground for most or all its life

whiskers – a long projecting hair or bristle growing from the face or snout of many mammals

The paper that inspired this work was:

Ecomorphology reveals Euler spiral of mammalian whiskers

By Gary Duggill¹, Eugene L. Starostin^{2,3}, Alyx O. Milne¹, Gert H. M. van der Heijden³, Victor G. A. Goss², Robyn A. Grant¹.

Published in *Journal of Morphology* 1-9 (2020) <https://doi.org/10.1002/jmor.21246> last accessed 20.12.21

1. Department of Natural Sciences, Manchester Metropolitan University, Manchester, UK
2. School of Engineering, London South Bank University, London, UK
3. Department of Civil, Environmental and Geomatic Engineering, University College London, London, UK

Partnership grant opportunity

'Whiskers' Research Project

The Royal Society Schools Engagement team, working with the Primary Science Teaching Trust, is currently providing an exciting opportunity for primary schools to become involved in a research project that has a schools' citizen science component, along with the potential for schools to develop their own projects from this.

The project

Dr Robyn Grant, a Royal Society funded researcher, is carrying out a project, 'Morphology, mechanics and movement of mammalian whiskers', to explore the effect of different whisker shapes, orientation and number on the way whiskers move. Eventually, she will use this research to make recommendations for tactile robot sensor design and control, which has applications for robotic exploration in environments where visual information is either unreliable or restricted, such as in marine archaeology, environmental monitoring and search and rescue operations.

During the project, the research team will explore animal sensing with primary school children across the UK. They will also produce a comic book and virtual careers sessions to demonstrate how an understanding of the natural world can inspire art, design and new technology.

"We will demonstrate in our project that science and scientists are important in everyday life, from

working in zoos to designing robots. We hope that this will be a highly effective way of encouraging awareness of science among children." (Dr Robyn Grant)



Guinea pig (credit: Dr Robyn Grant)

We would like to encourage schools to develop your children's own investigation ideas related to Dr Grant's project with support from a **Royal Society Partnership Grant**.

The Partnership Grants scheme is a fantastic way to acquire funding (up to £3,000) to carry out research in your school and this particular project makes the process much simpler for the following reasons:

- We already have a senior STEM partner who will be overseeing the research (meaning that schools have a lot more flexibility to find someone local to help with this project, for example from a local Wildlife Trust, the National Trust or other local support group)
- We will be able to provide a project rationale to support your application
- We will be doing a great deal of the planning for you (in terms of the investigations and the equipment list)
- You will be working collaboratively with other like-minded teachers – so this is a great opportunity if you are new to STEM engagement
- The team at the Royal Society will be supporting you at every stage to make your application successful

This new initiative will give students a unique opportunity to become involved in and contribute to real world research and to understand better the processes involved. Working with the PSTT and Dr Robyn Grant, this pilot project will involve up to 15 primary schools across the UK.



How might you develop an idea?

Each month, the PSTT publishes **I bet you didn't know...** articles on our website to enable primary schools to engage children with cutting edge research in the classroom. In this issue of Why&How, we look at Dr Robyn Grant's 2021 research paper: Ecomorphology reveals Euler spiral of mammalian whiskers – presenting this as **IBYDK...**

Why & How scientists measure mammals' whiskers.

Each IBYDK... article has an associated teacher guide with a presentation and practical ideas that can be used in the classroom. You will find a teacher guide for this issue's article online at pstt.org.uk.

We look forward to writing another article in the future to share the conclusions of this project. How amazing would it be for your children to have contributed to this research?!

We really hope that the preceding article will inspire your children to ask lots of questions about mammals' whiskers, enabling you to propose an investigation for them to take their ideas further with support from a Royal Society Partnership Grant.

Just a few ideas... your classes might like to:

- Explore whether there is a relationship between the number of whiskers and size of a mammal
- Visit zoos or wildlife parks to identify how animals use their whiskers
- Explore how easy it is to identify materials using different senses

There will be opportunities to:

- Contribute to the research by testing constructed whisker masks
- Meet Dr Robyn Grant and pose your own questions
- Take part in online workshops with your classes
- Receive additional funding to create a video diary of the project
- Extend the project to design a robot that functions by mirroring the way mammals use whiskers

If you're not sure where to start, the Royal Society Schools Engagement team is keen to help and has some ideas too! If you would like to get involved in this project, contact education@royalsociety.org.

Meet the scientist



Dr Robyn Grant carries out her research at Manchester Metropolitan University, in collaboration with the Wildwood Trust in Kent and Rhyl SeaQuarium. Much of Robyn's work investigates the sense of touch in mammals – specifically whisker touch. She describes the whiskers of lots of different mammals and tries to understand why whiskers are shaped the way they are, and how this is associated with their function.

She is currently working on a project focusing on the different shapes of whiskers in foxes, otters and seals. She is exploring how whisker shape might affect what an animal feels, by measuring whiskers, modelling whisker mechanics, and testing her ideas on robots and animals.



THE ROYAL SOCIETY

Sign up for the Royal Society UK teachers newsletter

By signing up you will have first-hand access to the latest opportunities and resources available for use in the classroom. Whether it is accessing funding opportunities via our Partnership Grants Scheme, accessing funded CPD, or using the Brian Cox School Experiments, the Royal Society Education Outreach team are committed to supporting teachers to undertake experimental work and problem-solving activities across the STEM subjects.

Brian Cox school experiments

A series of six simple experiments covering subjects from clean water to melting chocolate. Each experiment comes with resources and four short videos to support the teacher through set-up, the scientific method and health and safety. One of the videos shows the real world context of the science being investigated – a great way to get your pupils enthused. To obtain a free copy of all 24 videos and related resources, please email your contact details to education@royalsociety.org

Partnership grants scheme

Funding of up to £3,000 is available to enable pupils across all key stages to carry out investigative projects in all STEM subjects. The funding, which is used to purchase equipment not normally found in UK schools, must be applied for in partnership with a STEM professional (from research or industry). To find more information about the scheme, visit: royalsociety.org/partnership

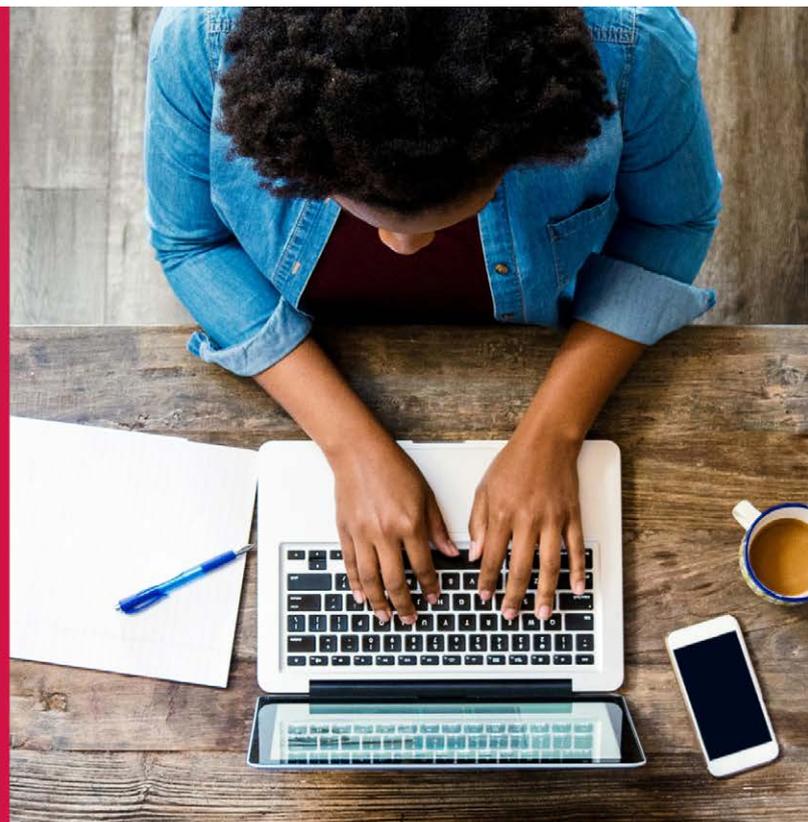
UK teachers newsletter

Keep up to date with all our resources, events and funding opportunities.

Sign up today

THE ROYAL SOCIETY

Image: © JGalione.



College Snapshot

Some of our PSTT College Fellows share their best ideas for improving teaching and learning in primary science. The PSTT **College** Fellows are all previous winners of a **Primary Science Teacher Award** (PSTA). If you know an outstanding teacher of primary science, click [here](#) to find out how you can nominate them for an award.



Gemma Robson
North Tyneside

Year 6 teacher and local leader for science
Date of Award: 2020



Kate Penarski
Abram, Wigan

Assistant Principal
Date of Award: 2020

Best science activity for building children’s collaboration and confidence post school closures?

Explorify has fantastic resources, but the Odd One Out activities are my favourite! They really encourage children to think more in depth about things, particularly when their peers suggest an answer which may be different to theirs.

Best tip for science subject leaders about raising the profile of science in your school?

Utilise all the resources and support networks available to you, and for improving assessment across the school, the **TAPS** pyramid is a great place to start. It breaks things down into really manageable steps, and each step you can tick off feels like a huge accomplishment!

Most used piece of equipment in your science cupboard?

Sticky notes! They’re a non-threatening way for children to share ideas and questions with the class, and can be used to structure the process of fair and comparative testing. I also carry a pack in my pocket when observing children working scientifically.

Best science activity for building children’s collaboration and confidence post school closures?

One of many team building examples is a class favourite: the spaghetti and marshmallow towers where children are challenged to build the highest tower they can out of only spaghetti (dried) and marshmallows. Or it can be done with cocktail sticks and mini marshmallows. Working in pairs one child could attach the sticks and the other child attach the marshmallows, encouraging them to work together to construct a structure while having lots of fun!

Best tip for science subject leaders about raising the profile of science in your school?

- Run a weekly science club (Crest awards can support with resources and delivery)
- Whole school science competitions
- Science trips and visitors to contextualise learning
- Share your super science lessons on social media

Best tip for increasing staff confidence to teach science?

Ensure staff have access to high quality science CPD that will equip them with good subject knowledge and pedagogical skills to share with colleagues. Team teaching can work really well to share teacher expertise and deepen subject knowledge.



David Rigmand
Renfrewshire, Scotland

Deputy Head Teacher
Date of Award: 2020



Jane Banham
Lincolnshire

Teacher and science subject leader and lead for Lincs/ Derby/Notts Science Learning Partnerships
Date of Award: 2020

Most recommended book/website for supporting teaching in science?

100 Ideas for Primary Teachers: Science is filled with exciting yet achievable ideas to build children's science capital and to engage them in all areas of the science curriculum. Written by two excellent primary science educators (Bryony Turford and Paul Tyler – both also PSTT Fellows), there is a variety of accessible activities that explore scientific processes, support assessment and engage the school community.

Science CPD that has made the most difference to you and the learners in your school?

The Royal Society of Chemistry website is a great resource that breaks down complex scientific concepts to primary level teaching points. The organisation also offers free training that is superb and builds teacher confidence in teaching science. The CPD has always been well received by teachers and its impact is evidenced in the classroom environment.

Best tip for increasing staff confidence to teach science?

Work with STEM ambassadors to build confidence and make links to STEM careers and STEM in society. Through the **Royal Society**, my school has been involved in brilliant renewable energy based projects working with Glasgow Caledonian University to raise science capital and teacher confidence in teaching STEM subjects. These projects have evolved over time and sustainable partnerships have been formed with the university. This allows us to call upon their expertise and work with university students to create purposeful and exciting lessons linked to learner interests.

Best tip for science subject leaders about raising the profile of science in your school?

Register with the **Great Science Share for Schools** as it has a plethora of information and ideas with ways to support children and staff with suggestions and resources to help plan a science filled day. The support includes ideas for lessons and investigations, and advice about opportunities to talk to scientists etc.

Most used piece of equipment in your science cupboard?

From the science cupboard, the most used thing is our 'working scientifically' boxes. Within each box are the pipettes, mini science pots (commonly known as shot glasses), measuring spoons etc. The children are always so intent and focussed when learning to measure accurately; this is a great skill for them to develop and apply in many situations, not only during science lessons.

Best video for supporting the development of children's scientific understanding?

Using Twig reporter as a quick real-life example of science in the world around us on a weekly basis creates a science focus that is outside a normal science lesson. The news reports you can find there engage the children and generate discussion, which often then supports them to make links to prior learning and begins to spark further questions, which can in turn lead to interesting enquiries and research.



Jacklyn Purdon

Cumbernauld,
Scotland

Acting Principal Teacher

Date of Award: 2020



Carla Wallington

London

Head of science and DT

Date of Award: 2020

Best tip for science subject leaders about raising the profile of science in your school?

Provide a wide range of Science CPD opportunities and share expertise across your school. Establishing yourself as a 'point of contact' will encourage staff to seek advice and ask questions, therefore increasing the breadth of activities on offer and the quality of learning experiences for young people.

Science CPD that has made the most difference to you and the learners in your school?

If you are in Scotland, SSERC Meets are an excellent source of CPD for primary teachers. Ahead of each CPD session, a box of resources is sent out to each participating school. This means teaching staff can undertake activities in collaboration with stage partners during the CPD session. In particular I highly recommend the Titanic SSERC Meet, based on the PSTT Titanic Science book by Jim McDaid. If you are not in Scotland and cannot access the SSERC Meet, you can still make the most of the **Titanic investigations** supported by video clips.

Science CPD that has made the most difference to you and the learners in your school?

PSQM! Starting out as an early career teacher, taking on the science lead with no prior knowledge seemed overwhelming and I did not know where to start. The PSQM award was a comprehensive and structured programme that supported me in my journey to improving standards for science across the school as well as improve my own leadership skills. I would be less confident to lead science if I hadn't undergone this CPD.

Best tip for increasing staff confidence to teach science?

Explorify has been a wonderful tool to increase teachers' confidence with science. Explorify's research found that in most primary schools, science is being taught for less than two hours a week. And one of the biggest barriers? Teachers' fear of being asked a question they might not know the answer to. Explorify aims to empower teachers by offering a range of short science activities that requires almost no preparation. The highly visual activities promote conversations among children and develop their thinking skills. I'd recommend starter activities like 'Odd One Out' or 'The Big Question' – they're a fun and exploratory way to encourage your children to think beyond the realms of the topic objectives. But perhaps most importantly, there's no right or wrong answer. The aim is to spark discussion and intrigue.



Jacklyn Purdon

Bristol

Assistant Head Teacher

Date of Award: 2020



Lowri Harris

Conwy, Cymru (Wales)

Science and technology Lead

Date of Award: 2020

Best tip for science subject leaders about raising the profile of science in your school?

A 'one day wonder'. Involve the whole school in a 'I wonder if...' event. The whole school is given the same question and any particular resources needed to explore and investigate the answer. Within each phase, children could work in cross year group teams of three or four, so one team might be a child from each of Y3,4,5,6 and another team would be a child from each of R,1,2.

Best video for supporting the development of children's scientific understanding?

BBC Lost Land of the Volcano. This is superb for discussion around how today is different from Darwin's day, and for considering, should we explore the last undiscovered regions of our planet? What parts of the world are still untouched? How might have Darwin felt? How and why do animals evolve and adapt? It is always so crucial for children to understand science as something that is relevant in all walks of life and to all of us. Children could really relate to this as well as appreciating the awe and wonder of our world and responsibility to look after it.

Most recommended book/website for supporting teaching in science?

Moth by Isabel Thomas – this captures, in a wonderfully illustrated way, the evolution story of the peppered moth and can be used as a hook prior to investigative science about adaptation.

Last by Nikki Davies – this provokes discussion about extinction and how it is relevant to us today.

Most used piece of equipment in your science cupboard?

Play-Doh is a well-used resource in my science lessons, loved by pupils up to year 6. Recent examples of tasks include modelling the human heart, labelling flower parts, and representing the butterfly life cycle. Our next Play-Doh activity will look at how we inherit our characteristics from our parents.

Best video for supporting the development of children's scientific understanding?

The last science video I showed my class was of Commander David Scott on the Apollo 15 mission simultaneously dropping a hammer and a feather on the Moon....a fantastic opportunity to discuss misconceptions that are linked to the rate of falling objects.

Best tip for increasing staff confidence to teach science?

Introducing **'I Bet you Didn't Know'** by PSTT is a great way to increase staff confidence. Cutting-edge science research is introduced through articles and teacher guides. Everything is included to deliver cross-curricular, exciting science lessons with confidence and success.

Collaborator update

The Association for Science Education

The Journal of Emergent Science (JES), published by the Association for Science Education (ASE) in partnership with the Primary Science Teaching Trust, bridges the gap between research and practice.



Hot off the press:

Issue 22, January 2022

Teachers interested in early years might particularly value the review of the recent research into science in the early years by Sarah Earle (JES Editor and lead researcher on the PSTT funded project, TAPS). Sarah considers the role of play and sensory experiences in the development of children's early scientific ideas. Another key area explored is the role of the adult in mediating learning experiences, and in facilitating dialogue to increase children's vocabulary.

The practitioner perspective section includes an article by PSTT Fellow Nicola Connor. She describes three case studies where teachers and children shared their science learning through writing stories. Nicola outlines the theory behind using more creative approaches to reporting learning before moving on to illustrate this with examples from practice.

➔ **FREE to download**



The journal is open access and covers early years through to the end of the primary phase. Articles focus on research and the implications of research for practice, and are organised into the following categories:

■ **Original research:** articles describing both small-scale practitioner research and larger projects are welcome for this section. These articles will

include descriptions of how the research was carried out, as well as discussions of findings and literature.

■ **Research review:** a summary of a larger project or perspective piece reviewing current research in the field. These articles will provide a review of current literature in the field or an accessible summary of research that has been reported in more depth elsewhere.

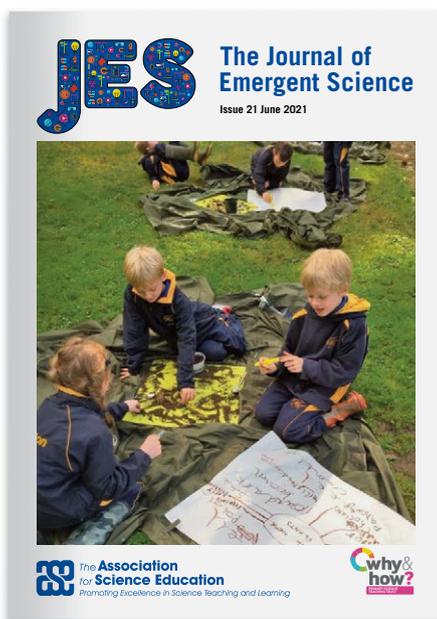
■ **Research guidance:** utilising relevant examples to provide support for practitioner research. These articles will consider research processes and methodology, supporting researchers at all levels to reflect on their practice.

■ **Practitioner perspective:** considering application of research from the viewpoint of the practitioner.

Contributing to JES

Contributions to JES are welcome, from practitioners as well as researchers, and full guidance about writing for JES can be found on page 43 of issue 22. Note that articles submitted should not be under consideration by any other journal or have already been published elsewhere. JES is a biannual online publication and copy deadlines are October for the January issue, and March for the June issue. All submissions should be sent to janehanrott@ase.org.uk in electronic form. Submitted articles are reviewed by the Editor, Editorial Board and/or guest reviewers.

In case you missed it: Issue 21, June 2021



In an extended research guidance article, Deb McGregor (Professor of Education at Oxford Brookes University and research lead on the PSTT funded project, **Teaching Creatively and for Creativity**) describes how action research approaches to practice can support teacher professional development. She gives extensive step-by-step guidance about how to conduct action research. Using examples from practice throughout, she shows how the approach can support an individual teacher or the whole school to evaluate the impact of a change in pedagogy or approach to learning.

As teachers and schools continue to address learning loss as a result of school closures, Cherry Canovan and Naomi Fallon's original research article provides some relevant insights. They highlight the effects of prioritising learning loss in English and maths over science, suggesting

that without action taken to address this, children's access to, and interest in, STEM careers will be negatively affected.

In another original research article, Polly Bell (PSTT funded doctoral researcher at Oxford Brookes University) and Deb McGregor consider teachers' perspectives of creativity in arts and science lessons. The research used a questionnaire approach with participants being selected for their subject expertise. They found that primary teachers' creative practices extend beyond the arts subjects, and are used equally in science. Teachers' descriptions of creativity are presented as word clouds: these would be useful points for discussion for staff development activity. The article also includes a helpful table for teachers to identify which pedagogical approaches will support the development of creativity in the children's learning.

Collaborator update

Primary Science Quality Mark



Jane Turner, Director of the Primary Science Quality Mark, shares some updates and reflections from PSQM in 2021 and plans and hopes for PSQM in 2022.

Looking back on 2021

What a year! PSQM is very proud of being part, with PSTT, of the friendly and expert primary science community that responded to the challenging times by providing powerful and valued support to 1000's of teachers.

Our hub leaders and subject leaders in schools were amazing. They embraced Zoom, and PSQM training for subject leaders in schools taking part in the PSQM programme was provided in this way, as was the PSQM professional development programme for hub leaders facilitated by PSQM HQ. Enabled by RSC bursaries, hub leaders also led additional online

CPD for their schools. Further RSC funding supported firstly the wide-reaching PSQM online festivals of primary science, led by hub leaders and Outreach subject leaders, and secondly, the introduction of a comprehensive programme of pre-recorded Spotlights for subject leaders to use, covering all aspects of the PSQM criteria.

We are even more proud of the 611 schools which achieved Primary Science Quality Marks in 2021. Despite the difficulties, the standard of PSQM submissions was impressive. Submissions evidenced an increase in the profile of science in all participating schools, teachers working together with drive, purpose and a commitment to CPD and improving science leadership, teaching and learning, subject leaders' increased confidence and agency, and enthusiastic children making real life links. Each submission was inspiring to read, and very worthy of achieving a Primary Science Quality Mark. This short film, which was made to celebrate the 2021 awarded schools, gives a taste of what science looks and feels like in a PSQM school. Watch it [here](#).

Enjoying whatever 2022 brings!

Our current cohort of schools working towards PSQM is the largest ever, with 814 schools taking part. The hub leader and HQ teams have risen to the challenge magnificently and subject leaders have developed action plans and are implementing these in order for their schools to meet the aspirational PSQM criteria.

We are all building on the learning of 2021: we know that PSQM schools said that home learning strengthened connections with parents, so we are encouraging them to continue to involve parents in their children's learning to build science capital; we are championing outdoor learning in science which has grown during the pandemic; we recognise that there are benefits to online CPD, so are increasing our programme of webinars and launching a hybrid model for PSQM training which will

mix face-to-face with on line sessions. Most of all we know that creating and enacting a strong vision for science is key to effective leadership and the transformation to science teaching and learning that this brings, so this remains at the heart of the PSQM process.

We are still in uncertain times, but PSQM has seen that clear vision, whole school collaboration, resilience, creativity, adaptability and resourcefulness, along with engagement with the wider community will help develop the confidence needed to drive science forward. We look forward to seeing this year's submissions. We know they will be inspiring.

If your school is interested in achieving a Primary Science Quality Mark, go to psqm.org.uk to register your interest.



Wider collaborations

The Royal Society of Chemistry



The Primary Science Teaching Trust works closely with the Royal Society of Chemistry (RSC). Here the RSC describe how schools are benefitting from their support for primary science, and they highlight some of the free resources on their new website for primary science.

Welcome to
Steps into Science

This dedicated primary science website from the Royal Society of Chemistry makes science fun and relevant for both teachers and children.

We believe that engaging young learners with scientific concepts at an early stage in their education can help spark a lifelong enthusiasm for science. The support and resources on the Steps into Science website can help you to feel more confident in teaching scientific concepts,

inspire young minds and ensure that STEM higher education and careers opportunities are available to everyone.

“Primary teachers play such an important role by introducing young people to science, helping them to recognise its relevance and applications in our lives. Steps into Science is a great resource which will help them to approach primary science with confidence, and to engage and inspire pupils.”

MARK JORDAN, Head of Education at the Royal Society of Chemistry

What is Steps into Science?

Steps into Science is a dedicated primary education website from the Royal Society of Chemistry – somewhere that teachers can see all our primary science resources in one place. Teachers can easily and quickly find high-quality, primary-specific information and ideas for making science engaging and accessible to all their students, whether they’re in the classroom or teaching remotely.

Secondary schools may have labs and technicians, but there are lots of fun investigations that can be easily done in primary school classrooms to really engage younger children and awaken their enthusiasm for science. There’s a misconception that investigations are complicated and time consuming to set up and that scientific concepts aren’t engaging

for primary age children. At the RSC, we wanted to debunk those ideas and show that primary science can be both accessible and exciting. One great example on Steps into Science is an investigation to find out about surface tension that uses milk, washing up liquid and food colouring. It’s really simple, visually engaging and works on two levels: the children enjoy watching the fun patterns and swirling colours, so they very naturally engage with and remember the ‘learning’ part – what surface tension is and how it can be broken. The great thing about this and our other investigations is that they use equipment that’s very easy to get hold of – there’s enough kit to make it feel exciting, and a change from other lessons, but not enough that teachers will struggle to find what they need.

Feedback from our members showed us that many primary school teachers feel a lack of confidence in teaching science. Our resources are designed to boost teachers’ confidence and help them feel comfortable and enthusiastic about their science lessons. Many of our primary science investigations were developed in partnership with the Primary Science Teaching Trust and written by PSTT Fellows, plus there’s a section of the website that focuses on ideas for cross-curricular activities, so that teachers can bring science learning into literacy, numeracy, history and geography.

Primary science investigations

The investigations are specifically designed to use equipment you can get in the supermarket so that they are not complex or expensive for primary school teachers to do and can also be done by parents at home. The purpose of these resources is to support teachers to feel confident to do the investigations with their classes and help 7–11 year-old learners practise key scientific skills like making predictions and taking



Dissolving, density and sugary drinks

measurements. Each one includes teacher guidance including an explanation of the background



Properties of gases, air pressure and 'sticky' cups

science, a demonstration video and FAQs, and the investigations are also available in Welsh and Irish.



Air pressure, gases and the leaky bottle



Caroline Skerry, PSTT Fellow and Junior School Headteacher at St Joseph's School in Cornwall, has been using the Steps into Science investigation resources with her key stage 2 learners.

I did the 'irreversible changes' and the 'fire extinguisher' lesson with my year 5 class. They created carbon dioxide by mixing vinegar and bicarbonate of soda, then used this gas to put out a candle. Apart from the utter amazement from my class that this was possible (and the delight from me that it worked), they prove that this chemical reaction was irreversible due to a gas being released, and the lesson also made gases a tangible state of matter.

Gases as a state of matter is something the children often find difficult to grasp, as it is quite abstract. The action of pouring the invisible carbon dioxide on to the candle, which then displaced the oxygen and extinguished the flame, really solidified their learning. This has been the outcome with many of the Royal Society of Chemistry primary science investigations; we achieve the learning outcomes I had envisaged plus a lot more.

I have really enjoyed teaching these lessons because they achieved what they said on the tin, created an atmosphere of awe and wonder in my classroom, gave me new ideas on how to teach familiar concepts, enthused all my learners and encouraged the children and me to have a go.

Sustainability contexts for primary science

One of the most popular areas of the Steps into Science website, these topic webs link science topics in the curriculum to sustainability issues and activities you can try in the classroom. They are designed to help teachers integrate sustainability into their existing science teaching and include activities to help develop numeracy, literacy and scientific skills. We find that young people



Biodiversity and habitats | 4–7 years

really care about sustainability, so it's an engaging context for science teaching. There are 20 contexts and each one explains the background



Electricity and batteries | 7–9 years

science, highlights the work scientists are doing to tackle sustainability issues, and suggests activities to try in the classroom.



Pollutants produced by chemical changes | 9–11 years



Francesca Atkinson, a teacher at Carlton Mills Primary School in West Yorkshire, has been using the Steps into Science sustainability contexts for primary science.

My year 4 class has been learning lots about climate change and the children are engaged and becoming extremely knowledgeable. From the sustainability topic web Melting Habitats on Steps into Science, we conducted an experiment to delay melting using different insulators, which provided a great opportunity for the children to work scientifically in a variety of ways. The experiment was inclusive for all learners to enjoy. The children were surprised by the results in comparison to their predictions, which led to scientific discussions about why results may differ.

As recommended by the web, I linked this experiment to a book called Leaf by Sandra Dieckmann, about a polar bear that drifts into woodland because the ice is melting. The web also suggested a video featuring Greta Thunberg speaking about climate change, and an experiment using red cabbage to detect acid or alkali in a range of solutions, that can be used to spark discussion about pollutants in animals' habitats.

We have planned a sustainability week in January linking to curriculum areas and will be using the topic webs across the whole school. I developed a web myself for the RSC about how plastic waste contributes to climate change and shared this and the other webs with schools in our academy. I received really good feedback from teachers who'd used the plastics web, which featured an experiment using mealworms to eat plastic.

Steps into Science

To see the investigation resources and sustainability contexts for yourself, as well as a wide range of other support and ideas to build your confidence and engage primary students in science, visit

edu.rsc.org/primary-science.

To access the full range of resources and to make sure you see the most relevant content for you, you'll be asked to register – but it's free to do, as well as quick and easy. We will

be adding a new section soon to support you in teaching your primary students about careers in science and the kinds of jobs they could aspire to, so keep an eye open for that.

➔ Find out more and visit [edu.rsc.org/primary science](https://edu.rsc.org/primary-science)



Key dates

11-20
MARCH
2022

British Science Week

14
JUNE
2022

The Great Science
Share for Schools

14
JULY
2022

UK ESERO's Mars Day

Activities and resources for schools,
with nationwide live and virtual events
for schools and the public held through
partner organisations during Mars Week,
14-20 March. Details [here](#).

**Nominations for
2022 Primary Science
Teacher Awards
are now open**

Closing date 15 July 2022

sharing
& learning

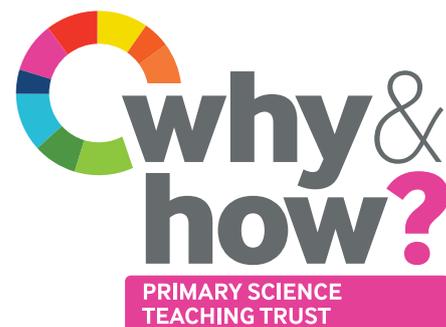
excitement
& exploration

discovery
& delight

investigating
& questioning

www.pstt.org.uk

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