I bet you didn't know...

WHAT'S NEW IN PSTT'S CUTTING-EDGE SCIENCE IN PRIMARY SCHOOLS PROJECT

Alison Trew

and her PSTT colleagues have created 30 '*I bet you didn't know…*' articles and teacher guides which link cutting-edge science research to the primary curriculum

Since the Primary Science Teaching Trust (PSTT) launched its Cutting-edge Science in Primary Schools Project a little over a year ago, we have written 30 *I bet you didn't know…* articles for primary teachers and children. Accompanying teacher guides describe related activities and investigations that children can carry out in the classroom. In this article we elaborate upon three further developments:

- **To demonstrate science is carried out by a diverse range of people, we have acquired photographs of the scientists who wrote the papers on which our articles are based.**
- **We reflect on the different ways that children can emulate scientists' work through their own investigations in the classroom.**
- **We have created an interactive *Overview* of all the articles published to date, grouping them according to the themes in the primary curriculum, so that teachers can search for an article that is related to their science topic.**

Aims of the project

When we started writing *I bet you didn't know…* articles, our aim was to share recent peer-reviewed publications of cutting-edge science research with primary teachers and children because we believe that cutting-edge research is interesting to children, and that children's attitudes towards science, scientists and the research process are enriched (Trew *et al.*, 2019). The first articles were published termly in PSTT's *Why & How* newsletter and described what the scientists did, suggested questions for teachers and children to consider in the classroom and included ideas for practical activities linked to the primary curriculum to make the research relevant to children. At PSTT's Primary Science Education Conference in June 2019, we launched a new webpage on the PSTT website (see *Weblinks*), which allowed us to publish articles on a monthly basis. Acting upon feedback from primary teachers, we started to create teacher guides to accompany each article, which describe in more detail investigations that children can carry out in the classroom and could be used as a classroom presentation (Trew *et al*., 2020).

Introducing scientists to children

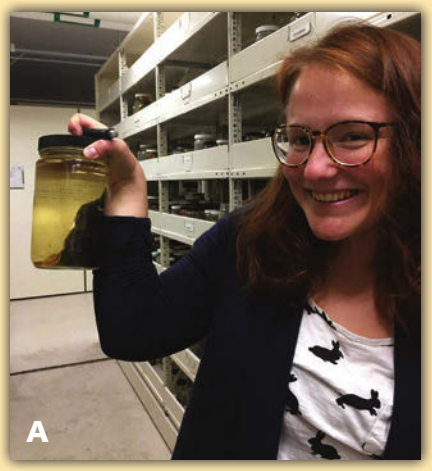
It is increasingly recognised that efforts to interest children in STEM subjects need to begin at primary school (Archer *et al.*, 2013). Many schools invite STEM Ambassadors or other science visitors into school, hoping that, through meeting a scientist, children will become more engaged, see that there is a purpose to studying science, understand scientific processes, and possibly see the potential for a future career. However, it is not always possible to find someone who is able to come, or who can link their research to the primary curriculum. It is also worth mentioning that inviting a visitor who is not representative of the demographic of pupils to run a one-off session that does not relate to the primary curriculum is very unlikely to develop children's science capital (Trew, Shallcross and Redhead, 2020).

Diversity in science research

We are mindful of the fact that the scientists who we introduce to primary children through our *I bet you didn't know…* articles represent a huge number of researchers across the globe. If we can show the faces of the scientists behind the research to primary children, then we could challenge some commonly held stereotypes; for example, that science is carried out by white, bearded men wearing white coats. This perception

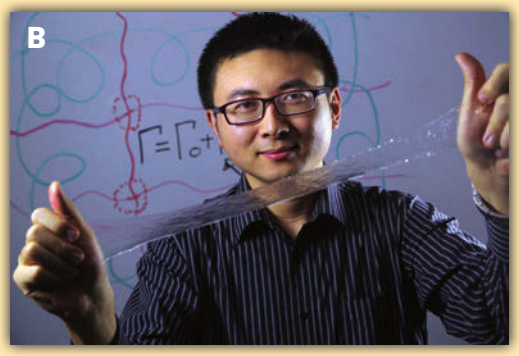
Key words: Cutting-edge research ■ Scientific enquiry ■ Science capital

Figure 1 Researchers who have inspired *I bet you didn't know...* articles



A. Dr Stephanie Smith works at the Field Museum of Natural History in Chicago, USA. She is holding one of the specimens from her study on hero shrews, which inspired our article *Some mammals have unusual backbones.*

B. Professor Xuanhe Zhao *(below)* works at the Massachusetts Institute of Technology, USA. He is holding a material used to make submillimetre robots. His work inspired our article *What small magnetic robots can do.*



C. Professor Karen Aplin works at the Department of Aerospace Engineering, University of Bristol, UK. Her work on atmospheric lightning in the solar system inspired our article *There is a storm coming and it is not going away.*

is perhaps reinforced by the National Curriculum in England (DfE, 2013), which, in its non-statutory guidance, suggests some scientists who could be studied: 13 males and 2 females, mostly white, mostly European, and all dead except one.

We have contacted the lead author (and sometimes the co-authors) of the papers that inspired our articles. Many have been happy to share a photograph of themselves or their team, which we have now included in the teacher guides, along with a little information about the scientist. Interestingly, there are still many more male than female scientists represented, but there is a diversity of people with whom children might identify (Figure 1). We will work hard to select research papers by a diverse range of people in the future, while ensuring excellent research (through the journals that the work is selected from).

Emulating research in the classroom

Teachers and children might be interested to know how closely their classroom investigations follow the methodology of the researchers and the reasons. From the *I bet you didn't know*… collection written to date, we found that the related classroom activities and investigations fall into different categories.

Children can copy the scientists' methodology using similar resources to carry out their own investigations. For example, *Stripes and concealment* (Shallcross, 2019) describes how researchers looked at different striped patterns on artificial moths to see which were easier for birds to see and for humans to see. Children could reproduce the researchers' investigation (Figure 2).

More often, the scientists' resources are not available to us in primary schools, but children can investigate the scientists' hypothesis using alternative resources and following a similar methodology.

Figure 2 *Stripes and concealment*

A. Many animals use stripes to warn that they may be dangerous or to help conceal them from predators

B. Children can reproduce the research described by creating artificial 'moths' and recording from what distance they can see them

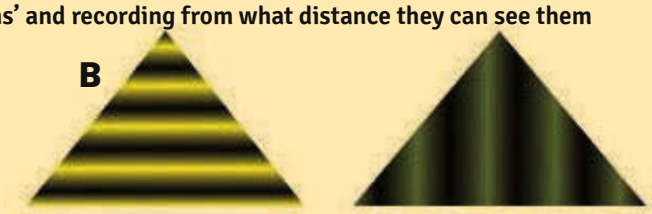


Figure 3

Slug slime might be the answer for medical adhesives

A. A species of land slug secretes a mucus that strongly adheres to wet surfaces

B. Children can mirror the research by making and testing the strength of different glues

Figure 4

Water can be harvested from the air in very dry climates

A. In water-stressed Uganda, people may have to travel long distances to fetch water

B. Children can explain the research by observing shaving gel absorbing water, observing condensation on cold surfaces and investigating which materials hold the most water

For example, *Slug slime might be the answer for medical adhesives* (Tyler, 2019) explains how scientists made and compared a range of adhesives based on the structure of slug mucus. In the classroom, children can mirror this research (Figure 3).

Sometimes the research processes are too complicated for children to follow, but children can understand the science behind the research by using completely different (but analogous) scientific processes. For example, *Water can be harvested from the air in very dry climates* (Nash, 2020) describes how scientists compared different types of chemicals to see which would capture and release the most water. In the classroom, children don't have access to complex compounds, but they can investigate other materials (Figure 4).

Whether children's investigations exactly reproduce the scientists' research, mirror their research or use analogies, feedback from teachers suggests that children see themselves as scientists when they know that their practical work is related to current research:

My year 2 class loved the activities suggested in the IBYDK article and really felt like they were scientists themselves when we were doing them. (Teacher, Whitnash Primary School)

Even when children's investigations use different science methodologies, children can understand the impact of the research and appreciate its relevance to real life. For example, *Catching flu might depend on the type of place in which you live* (Pemberton, 2020) describes how researchers compared recorded cases of flu from more than 600 cities with other variables to see how flu spreads. Children will not have access to this kind of data, but they can investigate how viruses spread (Figure 5).

Overview

Now that we have over 30 articles, which can be linked to most areas of the primary science curriculum, we have created an interactive *Overview* so that teachers can search for an article that is related to the topic they are teaching. This is available as a spreadsheet with four separate pages for biology, chemistry (materials), physics and climate science. On each page, the articles are listed under individual topics as hyperlinks, which will open the relevant article (see an example in Figure 6).

Summary

The PSTT continues to produce *I bet you didn't know…* articles each month. Many accompanying teacher guides have been revised to include images of the scientists to show children that science research is carried out by a diverse range of people from around the world.

There are different ways that children can emulate cutting-edge research and, by doing so, see themselves as scientists. Teachers are now able to search for *I bet you didn't know…* articles related to their science topics using the *Overview*. PSTT will continue to expand this database and provide a wide range of articles linked to every area of the primary science curriculum.

Figure 5 ***Catching flu might depend on the type of place in which you live***

Children can explore how far droplets containing viruses can spread and consider how to minimise the risk of a virus spreading

A series of **I bet you didn't know...** articles explaining cutting-edge research projects in language that primary children can understand.

Accompanying Teacher Guides (which could be used as classroom presentations) describe related investigations children could carry out.

https://pstt.org.uk/resources/curriculum-materials/cutting-edge-science-primary-schools

Light	Sound	Forces	Electricity	Earth & space
Ice giants at the end of the Solar System (7-11)	Whale song is changing (5-11)	What small magnetic robots can do (5-11)	How plants know good microbes from bad ones (5-11)	Planetary hide and seek (5-11)
There is a storm and it is not going away (5-11)	What happens underground when humans stay indoors (5-11)	Planetary hide and seek (5-11)	There is lightning at the edge of the Solar System (5-11)	One of Saturn's moons may be home to extra-terrestrial life (7-11)
	There is lightning at the edge of the Solar System (5-11)	Slug slime might be the answer for medical adhesives (7-11)		InSight into Mars (7-11)
		Some mammals have unusual backbones (5-11)		Ice giants at the end of the Solar System (7-11)
		InSight into Mars (7-11)		There is a storm and it is not going away (5-11)
				There is lightning at the edge of the Solar System (5-11)

Figure 6 Overview of all ***I bet you didn't know…*** **articles related to the primary physics curriculum**

Weblink

Articles and teacher guides are freely downloadable from:
https://pstt.org.uk/resources/curriculum-materials/cutting-edge-science-primary-schools

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