

Biochemical Society Outreach Grant Report

Wee Science Explorers

Taking science to rural schools

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Introduction

Smaller schools in rural areas tend to miss out on outreach programmes due to their size and location as well as a lack of funding. We felt that this was unfair and that everyone deserves an opportunity to experience science from a young age. For our outreach programme – Wee Science Explorers – we visited 4 small primary schools and 1 larger school where we carried out two different science workshops (DNA Explorers and Creative Chemists) with the students throughout the day. Each visit will now be discussed in detail.

Renton Primary School 22-11-2017 – DNA Explorers workshop


Class P5/6 - (19 students)

Class P6/7 - (30 students)

Class P7 - (29 students)

At Renton Primary School we visited three different classes throughout the day and delivered the same workshop to each. During this workshop we firstly gave a short presentation on science and being a research scientist.

What do we do?



Understand the things we don't know

Experiments

Study everything around us:


Human body
Animals
Nature
Space
And so much more!

Ask Questions:
How?
Where?
Why?

Answers

This was followed by an introduction into cells and DNA, with key points and interesting facts included. Students were encouraged to engage through questions and discussion throughout the presentation.

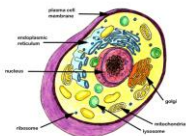
What is a cell?



All living beings are made up of cells - the building blocks of life

Over 30 TRILLION cells in the human body


200 different types



Cells have different functions:

Brain cells help us think,
muscle cells help us move around
eye cells help us see
and others help us stay alive


What is DNA?



The genetic code that determines all the characteristics of a living thing. Basically, your DNA is what makes you, you! Your own blueprint

Found in every cell

We share 50% of the same DNA as a banana!

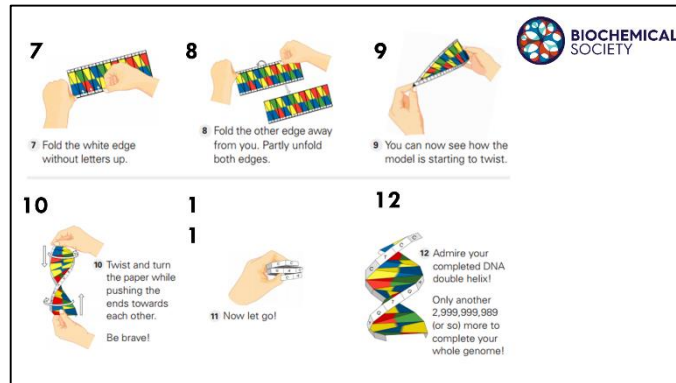


DNA molecules are shaped like twisted ladders made of bases - A, C, G and T - locked together in pairs. 'A' always pairs with 'T,' and 'C' always pairs with 'G.'

You got your DNA from your parents, nobody else in the world will have the same DNA as you

We're all 99.9% alike!

We then took the students through a protocol in which they extracted DNA from their cheek cells using salty water, soapy water and rubbing alcohol. This was followed by an explanation of the science behind each step and a discussion on why DNA extraction might be a useful tool. Finally, we demonstrated how to make a DNA helix using an origami template.



The students and teachers responded very well to the workshop and everyone was excited to see their own DNA. There was also a small group of students from the language and communication unit who did not want to participate in with the larger classes so we passed on the materials for the DNA extraction to the teacher who said they would do it in their own time. This school is in an area that is clearly lacking in funding and resources so for most of these children it was the first time they had experienced outreach of any kind which resulted in high levels of enthusiasm and engagement throughout. They asked some fantastic questions and showed a willingness to participate in discussion, with many saying that they wanted to be scientists when they grow up!

Logiealmond Primary School 29-01-2018 – DNA Explorers workshop

Class P1-3 (4 students)

Class p4-7 (10 students)

Logiealmond is a small primary school in Perthshire with a total of 14 students. We split the students into two groups and carried out a workshop in the morning with the P1-3 class. During this workshop we provided mini lab coats for each student and gave a short presentation to introduce the students to cells and what they do in our bodies. This was followed by a practical activity in which we used arts and crafts to decorate our own brain, bone, muscle and immune cells. We then got the students to place their cells in the correct location on a large outline of a human body. This was great because it allowed the students to think about the cells they had created and what they were doing inside the body and where they could be found. They all wanted to make multiple cells so it allowed them to understand the difference between the cells too.



We then moved on to looking at the cell organelles including the nucleus, mitochondria and cell membrane. To do this we made jelly cells using sweets to create each of the organelles. The students loved this (mainly because of the sweets) however it did help them recognise each organelle and the action it performs within the cell, which was a success. A piece of advice, do not perform this before lunch!



Moving onto the P4-7 class, like Renton Primary we gave a short presentation introducing science and what we do as research scientists. Then we spoke about cells and DNA and carried out the DNA extraction from cheek cells. As the class was smaller and we had more time we managed to take the students through the DNA origami during this workshop too, allowing them to see the structure of the helix. The students seemed to enjoy carrying out the practical experiments and were engaged throughout the full workshop.



At the end of the day each student received a science monster sticker and a certificate to show that they had taken part in DNA Explorers. We also allowed the school to keep the lab coats and materials used for the DNA extraction so that they can repeat the experiment again in the future.

Feedback from the headteacher

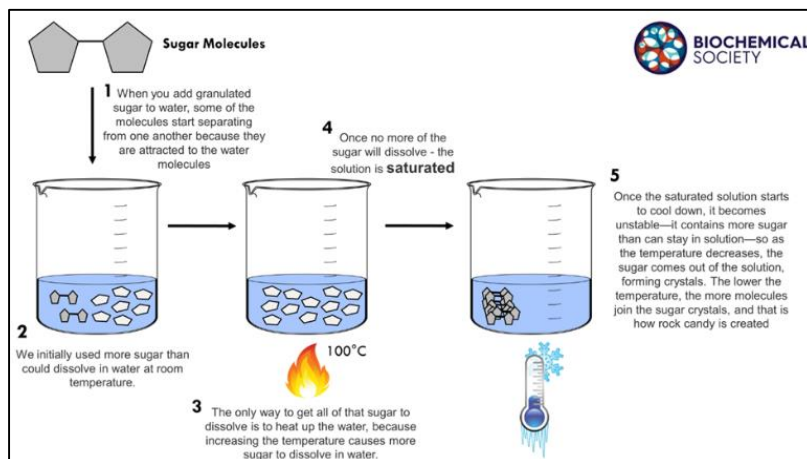
“Welcomed the opportunity for science outreach programme to come to Logiealmond and would love to have the opportunity again”

Pitcairn Primary School 30-01-2018 – Creative Chemists Workshop

Class p6-7 (12 students)

For Pitcairn Primary we had the one class for the full day which allowed us to carry out three separate experiments with the students. Before each practical we gave a short presentation explaining the science behind the experiment which the students engaged with questions and discussions about what we were going to do. After the presentations, the students were each given a lab coat and then we carried out the following experiments:

Sugar Crystals – The students labelled a small glass jar and used string, straws, rulers and scissors to prepare the string to grow the crystal on. They then had fun pipetting food colouring into the jars to colour their crystals. As the sugar water mixture was hot, we poured the mixture into the all the jars and they were left in the classroom for a week. This allowed the students to observe their crystals growing the days after the workshop.



pHing with cabbage water – The students each labelled ten test tubes and added 2ml of cabbage water with a pipette to each tube. They then tested 9 different household items to determine whether they were acidic, neutral or base by observing the colour change and using the pH scale provided. They were even able to determine, with relative accuracy, the pH value of all the reagents tested using the scale. Everyone loved this experiment and the students worked very well in groups to carry out the experiment and fill out their worksheets. They all wanted to keep their test tubes to display in the classroom.

- We can tell if a substance is an acid or a base by using chemicals that change colour if it comes in contact with an acid or a base.
- Red cabbage contains a chemical called **anthocyanin** that changes colour when it is mixed with an acid or a base.

The purple cabbage juice turns:

red/pink when it mixes with something acidic

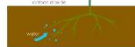
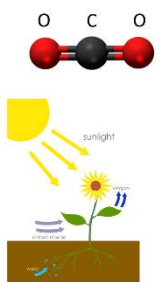
or



blue/green when it mixes with something basic.

BIOCHEMICAL SOCIETY

Making CO₂ – As the students learned in the previous experiment that vinegar is an acid and baking soda is a base, we used these two materials to make CO₂ in a bottle and inflate balloons. The students worked in groups to carry out three mini experiments by adding different amounts of baking soda to the vinegar and measuring the circumference of the balloon once it had stopped increasing in size. This allowed them to see a correlation between the reagents and the product. Again, this was great at promoting team work and the students seemed to really enjoy the multiple components to this experiment.

- Carbon dioxide (CO_2) is a gas that is found in the air but you can't see or smell it.
- It is not poisonous, we breathe in oxygen and breathe out carbon dioxide.
- BUT only a tiny fraction - just 0.04% - of the air around you is carbon dioxide! This is mainly because plants use it up in photosynthesis – converting carbon dioxide to oxygen
- Carbon dioxide gives fizzy juice their bubbles and is used in fire extinguishers





BIOCHEMICAL SOCIETY

- Baking soda is an alkali and vinegar is an acid. When they are mixed, the reaction creates carbon dioxide

At the end of each experiment the students received a related sticker to mark completion and they also received a certificate at the end of the day to show their participation in the Creative Chemists workshop.

Feedback from students

“Very good, fun and educational”

“We learned some new things we didn’t know about chemistry”

“Explained in a way we could all understand”

Crosshill Primary School – DNA Explorers 13-03-2018

Nursery – P3 (18 students)

P4 – P7 (12 students)

Minishant Primary School – DNA Explorers 14-03-2018

P1 – P4 (14 students)

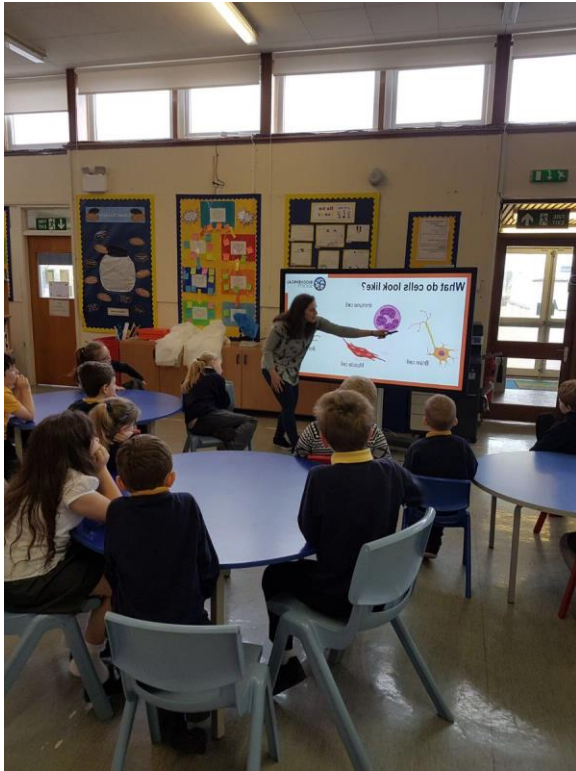
P5 – P7 (9 students)

The visits to these schools took place during STEM week and we carried out the DNA explorers work shop. The first half of the morning was spent with the P4 – P7 class where we gave a small presentation on cells and DNA and carried out the cheek cell DNA extraction experiment. We then introduced more detail about DNA and the bases that make up our genetic code. The students used the code and the matching base pairs to complete a DNA sequence which encoded their eye colour. This allowed the students to create these sequences using coloured beads to represent the different bases. We felt this helped them grasp that different sequences of base pairs encode the different proteins in our body but

also allowed them to create something which they could take home to remember what they had learned.



For the second half of the morning we made different types of cells using arts and crafts with the P1 – 3 students. This helped them to understand that our bodies are made up of many different cell types. We then drew around one of the students to have an outline of a body on a large poster which allowed the students to think about the functions of their cells and their location in the body. This activity was followed by making jelly cells to teach the students about some of the key cell organelles such as the cell wall, nucleus and mitochondria. After creating and labelling their jelly cell they then used paper to draw and label their own cell. These activities helped to reaffirm the concepts of different cell types within the body and the roles of the key organelles to ensure they had learned something new from the session.



Throughout both sessions we had a light microscope set up with slides of human skin, tongue and stomach tissue for the students to look at and experience what we would see in the lab. Everyone loved this part of the sessions and we had reactions ranging from “yuck” to “so cool!”. As it was STEM week we finished off the workshop with a question and answer session with the full school. We gave a short career presentation covering things like how we became scientists, what we do in the lab and some videos of experiments that we have conducted. This was followed by questions from the students which were very good and made an interactive finish to the workshop. We completed the day by presenting the students certificates for taking part in Wee Science Explorers.

Crosshill feedback comments:

“We would welcome Science Explorers back anytime to our school. The sessions were well organised, informative and engaging for all of our young people. Rachel and Mark were approachable for the children and really got down to their level. It was a pleasure having them in the school. To hear some of our children say that they would like to be scientist speaks volumes about the quality of the sessions.”

Minishant feedback comments:

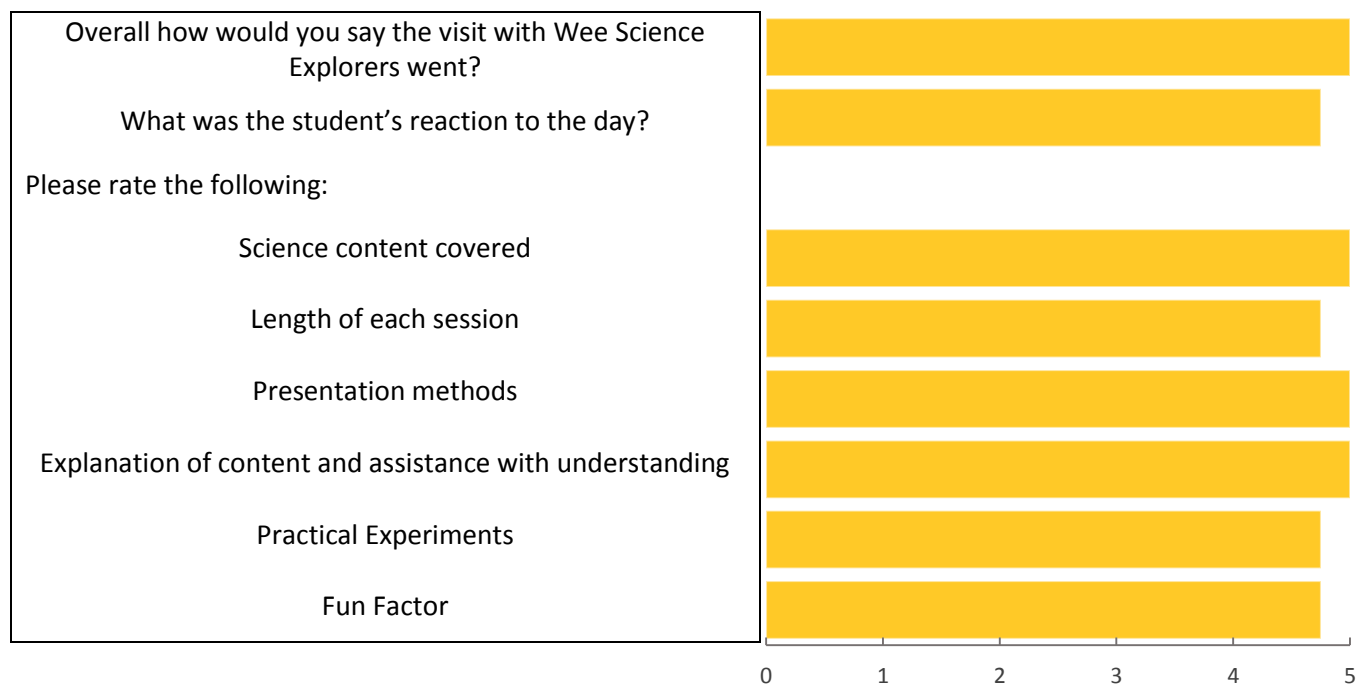
“Both Mark and Rachel were extremely knowledgeable and keen to share this at an appropriate level for all children. Their sessions were inclusive, interactive, informative and most of all fun! We would welcome Science Explorers back to our school in a heartbeat! I can confidently say they have inspired some young (and old) minds.”

Conclusions

Overall, we feel that Wee Science Explorers was a great success. With each school we learned and grew along the way and made improvements to the workshops. All of the schools that we visited said that they would love us to return for another workshop, demonstrating that it was received extremely well by each school.

Average feedback scores

1 = Very Bad 2 = Bad 3 = OK 4 = good 5 = very good

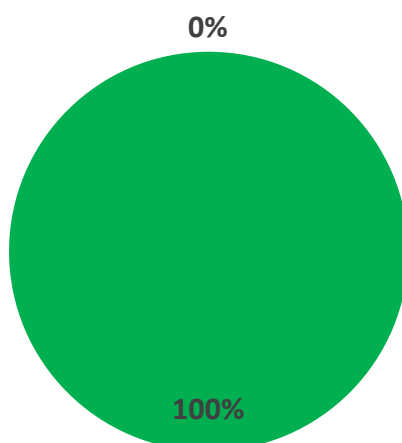


If possible, would you like Wee Science Explorers to return to your school?

Yes

No

■ YES ■ NO



Acknowledgements

We would like to thank the Biochemical Society for funding Wee Science Explorers and allowing us the opportunity to take science to rural schools. Also all of the schools who participated in this outreach programme were very welcoming and enthusiastic, which made it a pleasure to visit your schools.