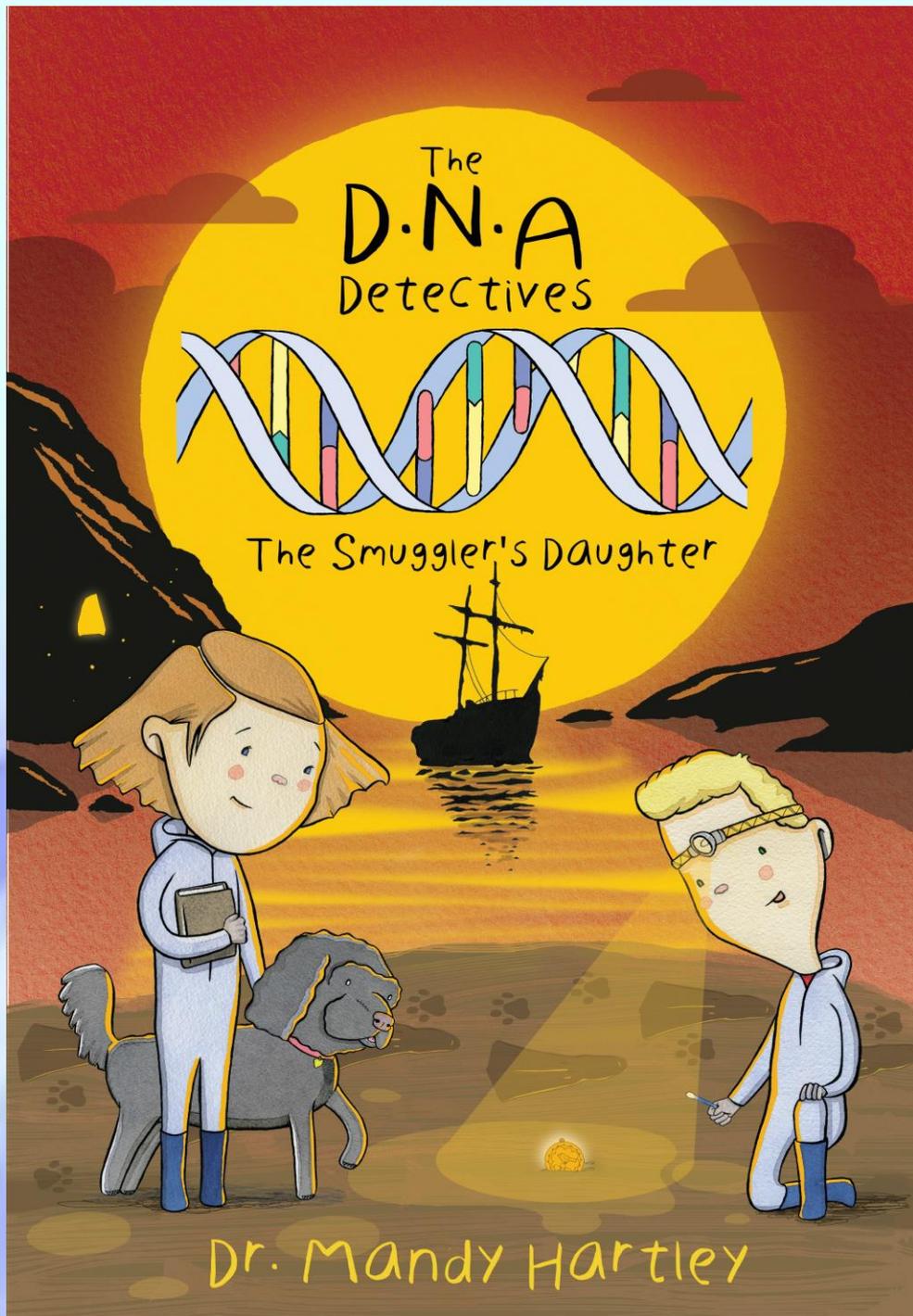


'DNA Detectives – The Smuggler's Daughter



Aim:



The aim of this session is to inspire children with a love of science and literacy through a “hands-on”, interactive workshop based on the book “The DNA Detectives – The Smuggler’s Daughter”. Alongside the thrilling plot children reading the book and participating in this workshop will learn about DNA, cells, inheritance, mutations, smuggling and ship wrecking.

Introduction:

It has been argued that the discovery of DNA and the understanding of its structure and functioning may well be the most important discovery of the last century. DNA is fundamental in our lives today in helping us to understand and treat diseases, develop gene targeted drugs and therapies, introduce better strains of crops and animals to feed the world, to trace families, unlock historical secrets and establish paternity and combat crime through forensic investigation. With such a key role in modern life it is a huge advantage for children to have a good understanding of the fundamentals of this subject.

In my experience if you have a solid understanding of the basic concepts of a topic, this will provide a fantastic platform that can be built on and makes it easier for children to understand more complicated extensions of this subject later on. For example, a child who has learnt the basics of DNA is likely to find it easier to understand topics such as inheritance, transcription and translation at secondary school.

The workshop is designed so that children learn about what it is like to be an author, what gave me the ideas for this book and how I wrote it. They will learn what DNA is, where DNA is found in the body and use DNA to find out what Henry Nance (the head of the smuggler’s) looked like, to find out the cause of Elise’s (the smuggler’s daughter) polydactyly, to find out if anyone in the audience originally came from Cornwall or Norway and to see if there are any relatives of Henry or Elise so we can return the lost treasure to its rightful owner.

This interactive workshop is a unique and exciting way to get children interested and excited about literacy and science.



I want them to get really excited about reading and writing, being creative and using DNA to solving mysteries from the past.

Within the workshop there are lots of visual demonstrations and tasks for the children to take part in so they can really understand what is going on. The work shop is designed to be interactive with children encouraged to come up with the answers and to ask their own questions. In my experience this approach to learning is a fantastic way for children to really grasp different concepts.

My aim is to share my love of science and literacy with the children and to inspire them to become interested in learning about literacy, being an author and science. I think this is particularly important for the girls who sometimes fail to engage with science as they perceive it to be too hard. This workshop could be the starting point for budding authors, scientists or geneticists of the future!

Proposal:

This interactive workshop can take place in a classroom or hall with up to approx. 150 children. Ideally children will have read my book "DNA Detectives – The Smuggler's Daughter" as a class prior to the workshop but it is not a problem if this has not been possible. On the stage is a ship, smuggler's tunnel, pallet, rocks and a table with various props. The workshop will take approx. 1 hour (depending on how the children interact).

The sessions always start with an introduction. I will introduce myself to the children and explain how I spent many years working with DNA in a laboratory and used DNA to solve crimes and find out about different diseases. I tell them that now I am an author and I write exciting fictional books where children use DNA to solve crimes. I then explain what we are going to do in the session.

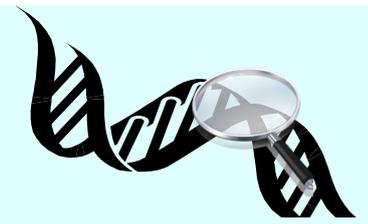
1. I will explain what made me want to become an author and what I like about being an author.
2. I will explain why I wanted to write this book and where my ideas for the book came from. I tell the children about my research trip to Cornwall and my trip to the smugglers museum and Jamaica Inn.
3. I explain the process I go through when I am writing my books. I explain when I have a location where something is happening I think about the five senses. I think about if you were standing in that location what you can see, hear, taste, touch and smell. I get the children to tell me which organs are associated with the different senses.



4. I ask for two volunteers to play children who are staying in a holiday cottage in a small village near the sea in Cornwall. I explain that while playing in their bedroom they notice one of the floor boards is a bit creaky. When they bend down to examine it they discover a note under the floor.
5. I read the letter to the audience. It opens with "if you have found this letter then I must have been caught by the Kings men and sent away to the colonies. I asked my wife to hide the letter here under the floor boards in case one day she should need to find where I have buried my treasure". It is the story of Henry Nance the head of a gang of ship wreckers who used to live in the holiday cottage which was once the village Inn. I get volunteers to act out the story in the letter and play the parts of Elise and two of the King's men.
6. The sound of thunder and lightening fills the air and we watch as Henry Nance puts a lantern out on the rocks to lure the ship out on the ocean onto the rocks. We see Elise onboard. There are barrels in the sea and as the ship hits the rocks it starts to sink. Elise falls into the sea and is rescued by Henry and brought ashore.
7. There is the sound of gunshots. Henry realizes the King's men are on their way. He gives the lantern to Elise, picks up the barrel and quickly ushers her into the smuggler's tunnel in an attempt to escape.
8. The King's men appear and ask if we have seen Henry. They are led into the tunnel. Henry knows of a secret place where they can hide. The audience see them creep out of the tunnel through the secret entrance. Worried they will be caught they leave behind Elise's locket and Henry's lucky tooth in a leather bag under a rock. The Kings men capture them as they try to escape.
9. I ask the children on the set if they would like to look for the treasure? They find it and I explain we really need to return it to the rightful owner – wouldn't it be exciting if we could find a modern day relative of Elise? I also ask if they would like to know what Henry Nance might have looked like in real life? I explain we can answer all these questions using DNA which we can get from Henry Nance's tooth and the hair in the locket.
10. In order to this we need to find out what DNA is. I start with box of Lego and ask the children what they could use to help them make the Lego model. I wait for someone to say 'use the instructions'. I then explain that DNA contains the instructions to make a whole human being. I ask the children to think about what might be in those instructions and take examples from some volunteers e.g. the instructions to make the heart, lungs etc. I explain DNA stands for Deoxyribo Nucleic Acid but they can call it DNA!



11. I remind the children what we have learnt that human DNA contains the instructions to make a human being and ask 'but where is it in our bodies? I explain that DNA is kept in a special bag in the body called a cell and that the cells protect the DNA and stop it from being damaged. I show them the model of the cell. I show them the cell membrane around the outside which keeps all the bits in. I then show them my gel filled model to demonstrate the role of the cytoplasm. I explain our DNA is found in the nucleus of the cell and show them the nucleus in the model.
12. We play a game of Operation to look at the different parts of the body and decide whether they are made of cells. I explain we have 37 trillion cells in our bodies and they all contain DNA (apart from the red blood cells). I explain that cells are so small we have to look through a microscope to see them. I show them a slide with cells from different parts of the body. We discuss how cells can be lots of different shapes but they all have a nucleus which contains DNA.
13. I explain to the children we are going to find out what the DNA in the nucleus looks like. At this point I will remove the nucleus from our model cell to show the children where the DNA is. I explain that 'all' the DNA in the nucleus is called the 'genome'.
14. I show the children that the instructions to make the Lego model kit are divided into two books. I explain in human DNA the instructions are divided into 46 books in total which we call 'chromosomes'. I open the nucleus and show the children the chromosomes made of DNA. I then get out a large magnifying glass and explain if we zoomed in we could see the DNA that makes the chromosomes folded up into a DNA Helix (I show them my model of a DNA Helix).
15. I explain to the children if we looked at the instructions to make our Lego model each page has the instructions to make a different bit of the model. Our DNA is a bit like this. The DNA that makes up the chromosomes is divided into different sections like the pages of the Lego instructions and each page makes different parts of us and they are called 'genes'. Humans have about 20,000 genes. I use the magnifying glass to zoom in on the chromosomes to show the genes. I then show them our model of the genes made out of coloured balls. I explain we can look at the genes for hair, eye and skin colour to find out what Henry Nance would have looked like.



16. How do scientists do it? I explain in our Lego kit the instructions are written using the letters of the alphabet. I ask the children how many letters there are in the alphabet. I explain DNA uses just four letters or building blocks and name the bases Adenine (A), guanine (G), cytosine (C) and thymine (T). I show them my four Lego blocks. I show the children a model head. I then ask for some volunteers to hold the DNA from Henry Nance. It is divided into different sections "genes" for skin colour, eye colour and hair colour. Each section has a label on it.
17. I explain that first we are going to try and identify the skin colour. I ask for volunteers to hold up DNA which I explain is part of a gene. One is for light skin, one for medium skin and the other for dark skin. The children identify that Henry had light skin. I put a pair of pinks tights over the model head. We now identify the hair colour. Again, I ask the volunteers to hold up the DNA sequences for red, blonde and black hair. We find Henry had black hair. We now identify the eye colour. I ask for a volunteer to hold up the DNA sequence for blue, green and brown. We find out he had green eyes.
18. I finish by explaining how scientists in real life use computers to compare DNA sequences and don't just look at one gene they can compare up to 13 genes to try and work out what eye colour, skin colour or hair colour someone has. They can even tell if someone's hair is wavy, straight or curly or whether someone has a disease. I explain how forensic scientists are using DNA, dental records and facial reconstruction techniques to try and help identify someone if they find a body and now this is being used by archaeologists to find out more about ancient remains. I use examples of cheddar man.
19. Can we use DNA to find out if anyone here is related to Elise so we can return the treasure? I explain how scientists started by sequencing the DNA from just one person and they compared the DNA sequence from everyone else to this. I demonstrate this using my peg board. I explain that they found something interesting the more people they sequenced. They found in some people some bits of the pattern were different and in some people it was the same. These patterns are passed on from generation to generation. They noticed that people who originated from the same geographic areas had the same pattern and they could use this to work out where people had come from.



20. I say to the audience we are going to pretend I have extracted DNA from them all. I ask them to look at their results. I then show them the results including the results from the DNA extracted from Elise's hair and ask if anyone is from Norway (we have about 10 candidates).
21. I then explain there is something unusual about Elise. I show the audience her toes and explain she has polydactyly. Polydactyl (having an extra finger or toe) is quite common. One in five hundred people will be born with an extra finger or toe. She has a spelling mistake in her DNA in her instruction booklet number 7, i.e. Chromosome 7. The page of the instruction booklet where the mistake is "the gene" is called GLI3! This gene helps control how your fingers and toes develop before you're born.
22. We talk about different types of mutations or "spelling mistakes" in your DNA. I explain there are lots of different mutations sometimes letters might be inserted, sometimes substituted. I show them the DNA sequence from someone without polydactyly and compare it with Elise's DNA. I explain she has a very rare mutation, a deletion (I ask the children to try and work out what type of mutation she has. She is missing an "A and a G". I ask the audience to look at their sequence data. Do they have a deletion? If so as this mutation is so rare there is a good chance they are related to Elise. The relation is revealed and we check to see whether they have polydactyly. I hand the locket over to the rightful owner. I then explain about Adrian Targett and Cheddar man, and Tutankhamun and how useful DNA can be for identifying mutations to diagnose diseases and treatments for patients. I also explain how DNA can be used to find out where people came from, reunite families and to unlock secrets from the past.
23. I ask if anyone has any questions about the session.