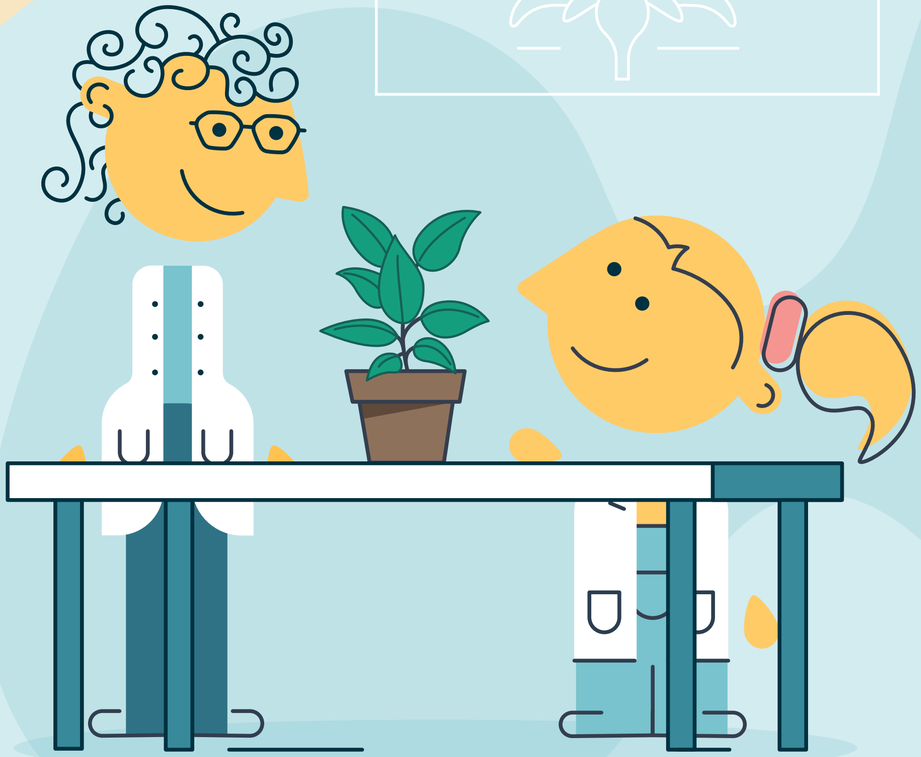
Ellie and the Forensic Ecology Mystery



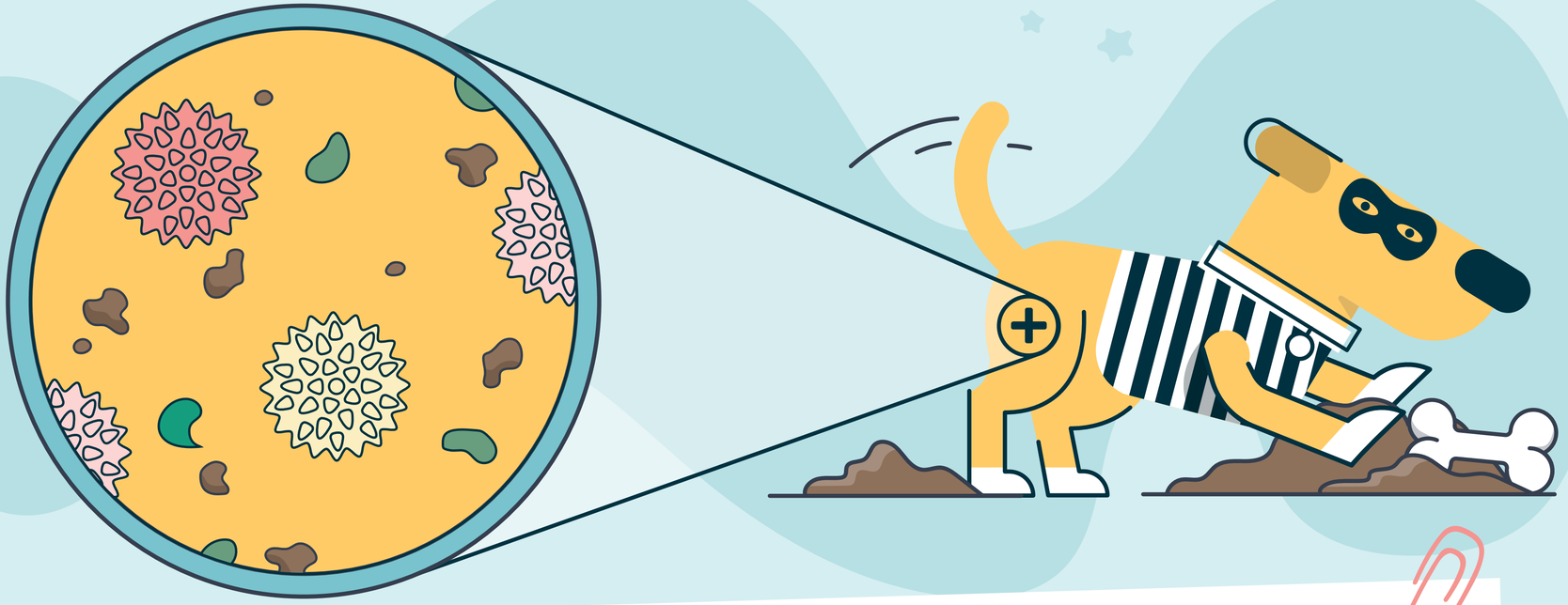
It was a Saturday morning and Rusty was in the hallway looking rather a mess.

“Rusty, you naughty dog. Where have you buried my car keys?” called out Ellie’s stepdad, Kai.

Rusty’s tail stopped wagging as he ran into the kitchen and sat next to Ellie.

“Why don’t you look in the last hole he was digging in?” suggested Ellie.

“Which one?” said Kai scratching his head. “Our front and back gardens are full of holes!”



“I know who can help! Our neighbour, Dr. Simpson. She’s a Forensic Ecologist. She helps the police catch people who steal things, a bit like Rusty!” said Ellie.

“She told me, when people, animals, clothes, or objects have been in contact with the outside, they become covered in pollen, soil, and plant fragments.

“She can use this as evidence to show where someone has been, even a dog! This could help us find out where Rusty has buried your keys.”

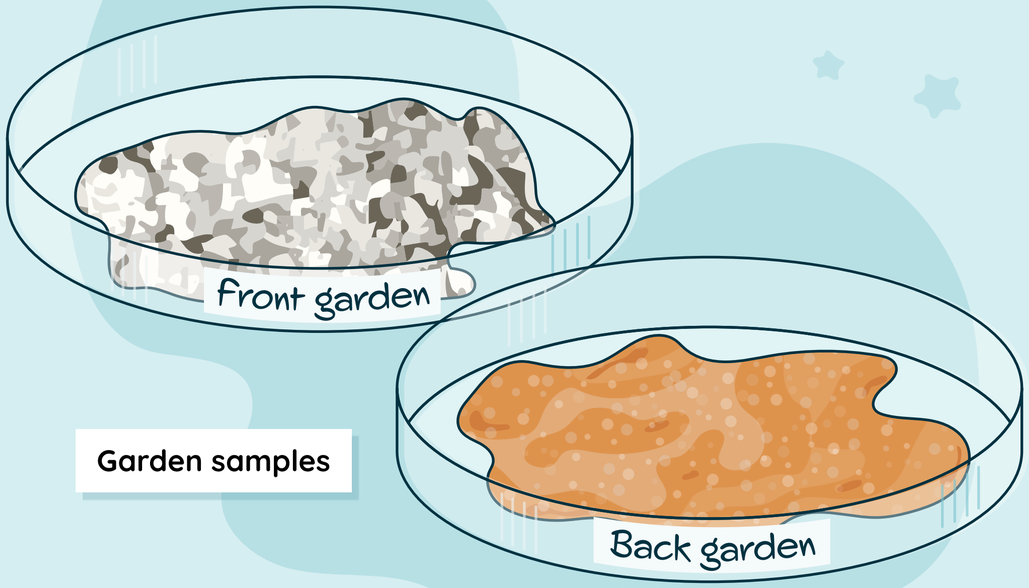
“Amazing! Quick Ellie, go and ask her if she can help,” said Kai. “I need my keys!”

Dr Simpson was delighted to help and let Ellie borrow a lab coat. “We should collect evidence from the gardens and from Rusty straight away!” she suggested.

Ellie’s favourite teddy, Mags, also put on a lab coat. She was ready to help with the investigation.

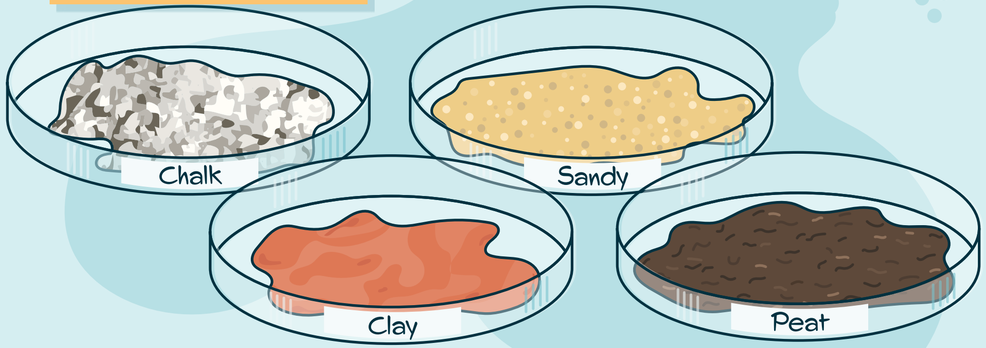
Ellie helped Dr Simpson use a water bottle, brush and swab to collect soil, plant fragments and pollen from Rusty’s collar and his paws.

They also collected soil samples from Ellie’s front and back garden.



Garden samples

Reference samples



"Forensic Ecology involves lots of different jobs. Our first job is to be a Forensic Soil Scientist," said Dr Simpson.

"To find out where Rusty buried the keys, we need to identify what type of soil is in both gardens and compare the result to the soil on Rusty's collar and paws," continued Dr Simpson.

"Let's compare the colour of the soil in the front and back garden with these reference samples of sandy, clay, peat and chalk soils. Can you identify the soil type Ellie?"

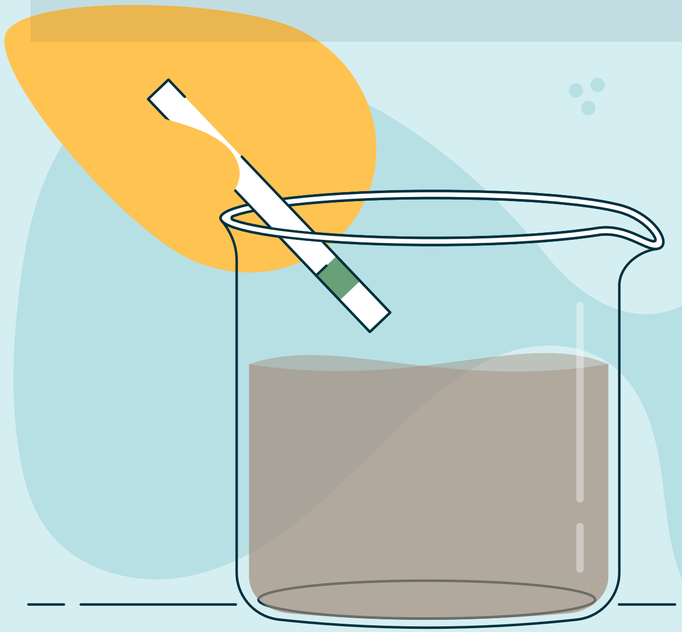
“The soil from the front garden is white. It’s chalk!” said Ellie. “I don’t know about the brown soil from the back garden. Is it clay?”

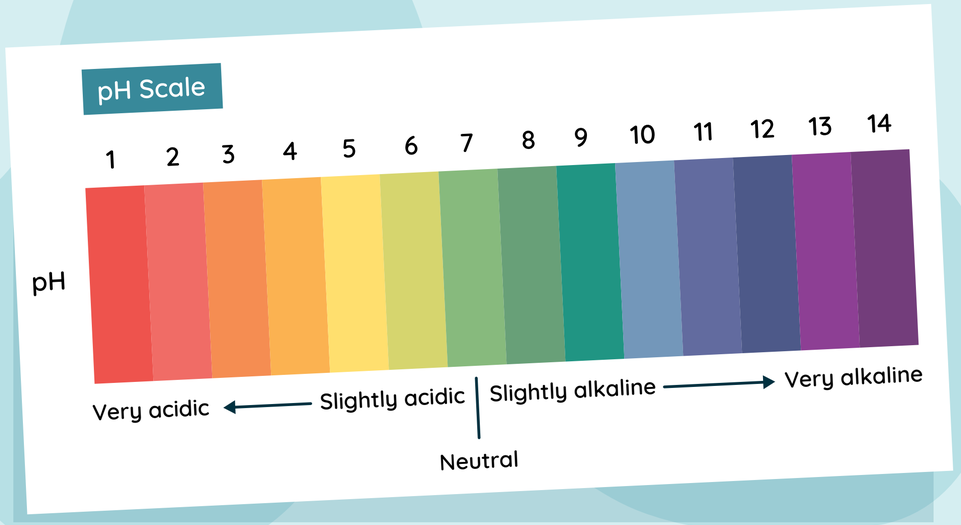
“The amount of water in the soil can affect the colour. We need another test. Let’s use something called pH! We can use it to see if the soil is an acid, like vinegar, or an alkali like soap,” suggested Dr Simpson.

Soil from the back garden was put into a beaker and mixed with water, before adding a strip of special universal pH paper. It changed colour!

“What colour is it? So, what pH is the soil? Is it an acid or an alkali?” Dr Simpson asked.

“It’s green! I think it’s pH 8. It’s an alkaline soil,” said Ellie.



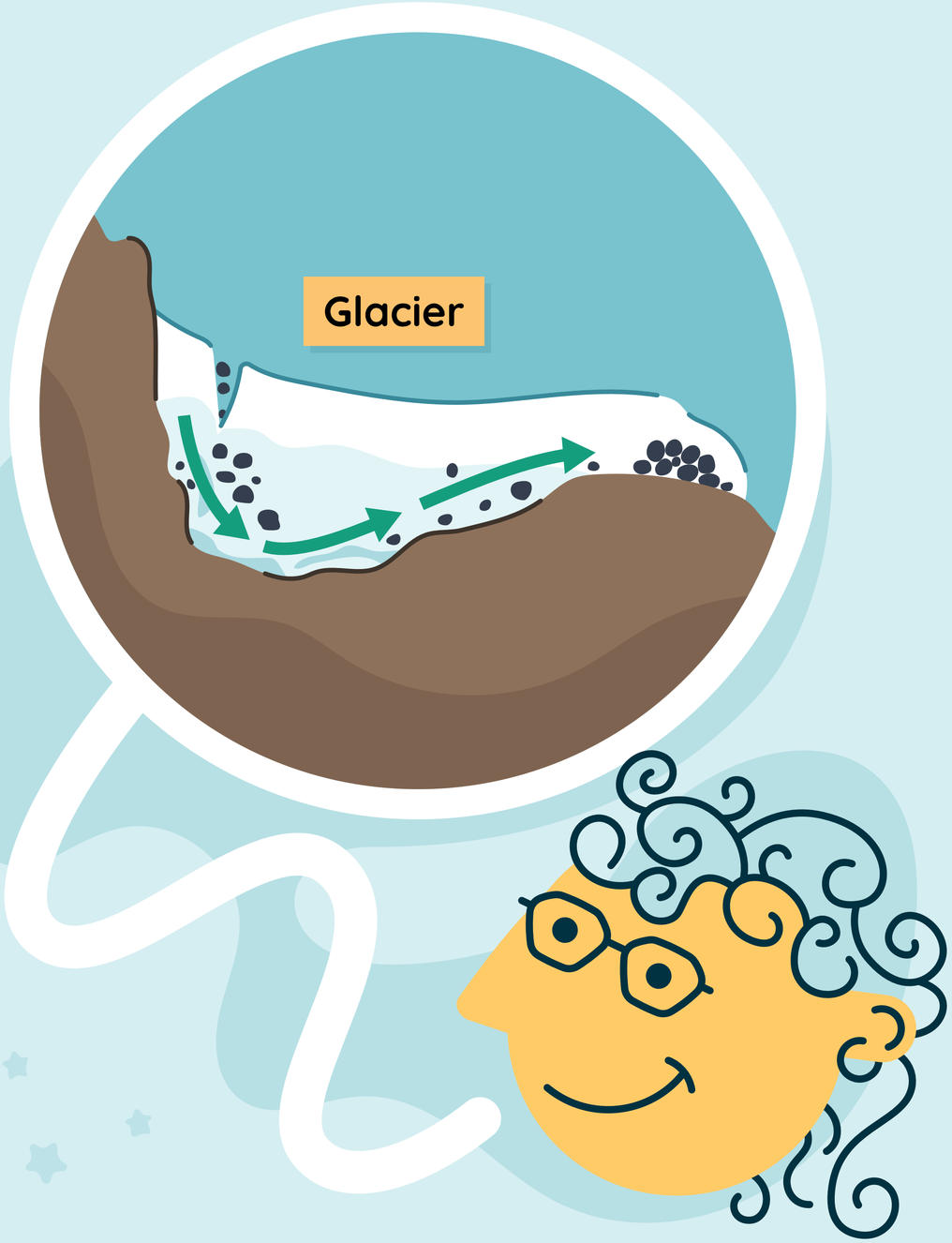


“Looking at this table of pH values for different soil types,” Ellie continued, “A pH of 8 means it’s not peat, because that’s acidic and has a pH of 3-5. So is it sand, or clay?”

“We need to look at the texture to find out!” said Dr Simpson. She showed Ellie her microscope. “This allows us to magnify the soil, to make it look bigger and really close up.

“Look at the soil from the back garden, what do you see? Is the texture more like a clay or sandy soil?”

“There are big lumps and tiny little grains,” answered Ellie. “I think it’s a clay and sand soil.”



“Correct! The clay and sand was carried here by a glacier during the ice age. When the glacier melted, the clay and sand were deposited here in your back garden.

“Your front garden was covered in an ancient warm, shallow sea. Over time tiny sea creatures made up of shells and skeletons died and fell to the bottom of the sea. They became covered in layers of mud. Over millions of years these layers squeezed together, hardened and formed chalk. We call it a sedimentary rock.

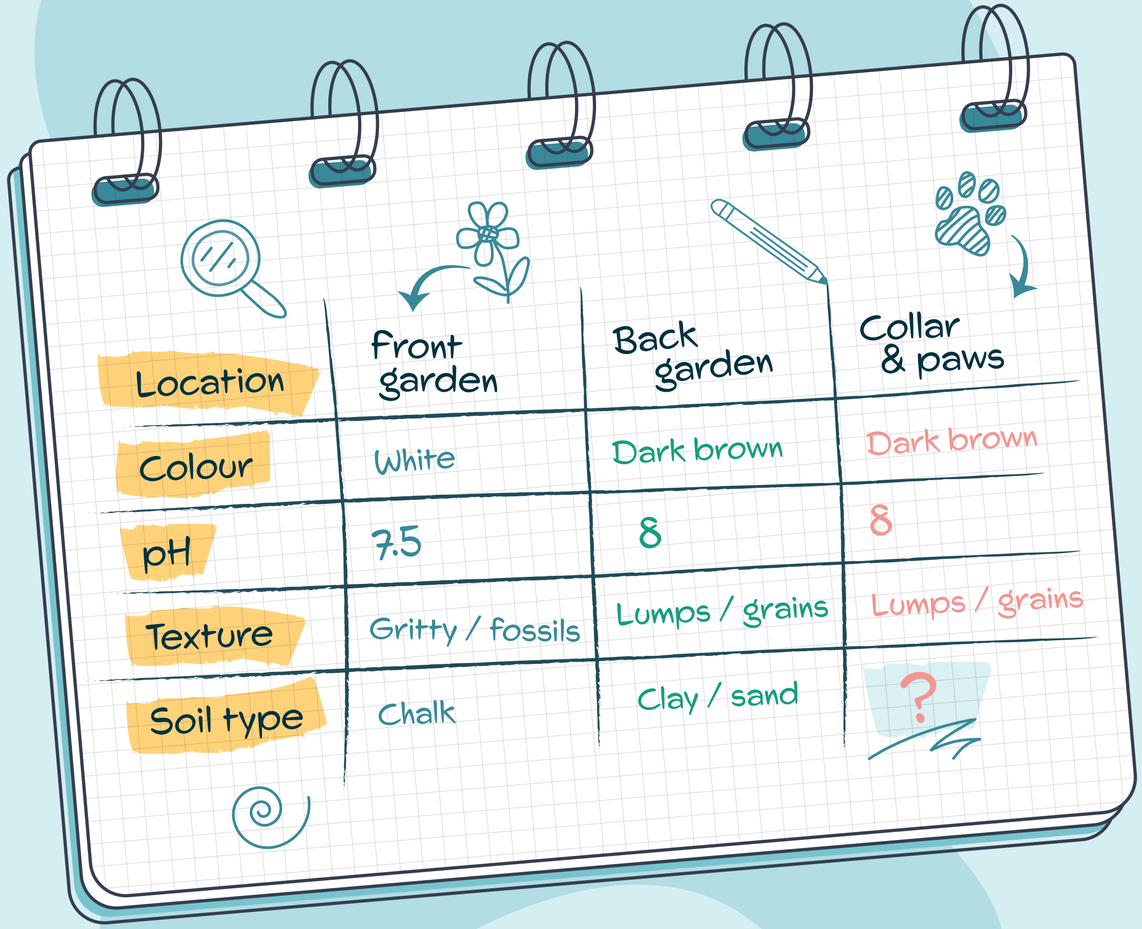
“This is helpful for our investigation. If you test the colour, texture and pH of the soil on Rusty’s collar and paws, you can find out which garden he buried the keys in.”

Ellie carried out the tests and wrote the results in her notebook.

“Can you work out the soil type?” asked Dr Simpson.

“It’s clay and sand, so it’s the back garden!” said Ellie with delight. She looked over the fence into her garden. “It could be anywhere though!”

“To find exactly where he buried it,” said Dr Simpson, “we need to see if there are any plant fragments in the soil we collected from Rusty.”



“Someone who uses plants to solve crimes or locate crime scenes is called a Forensic Botanist. They look for fragments of plants in soil samples taken from a suspect’s car, clothing, shoes or even dog paws!

“We rarely find whole plants. Mostly, fragments of plants, a petal, a seed, a berry, a leaf or a stalk. The smallest details like colour, leaf shape, hairs or roots can help identify a plant.

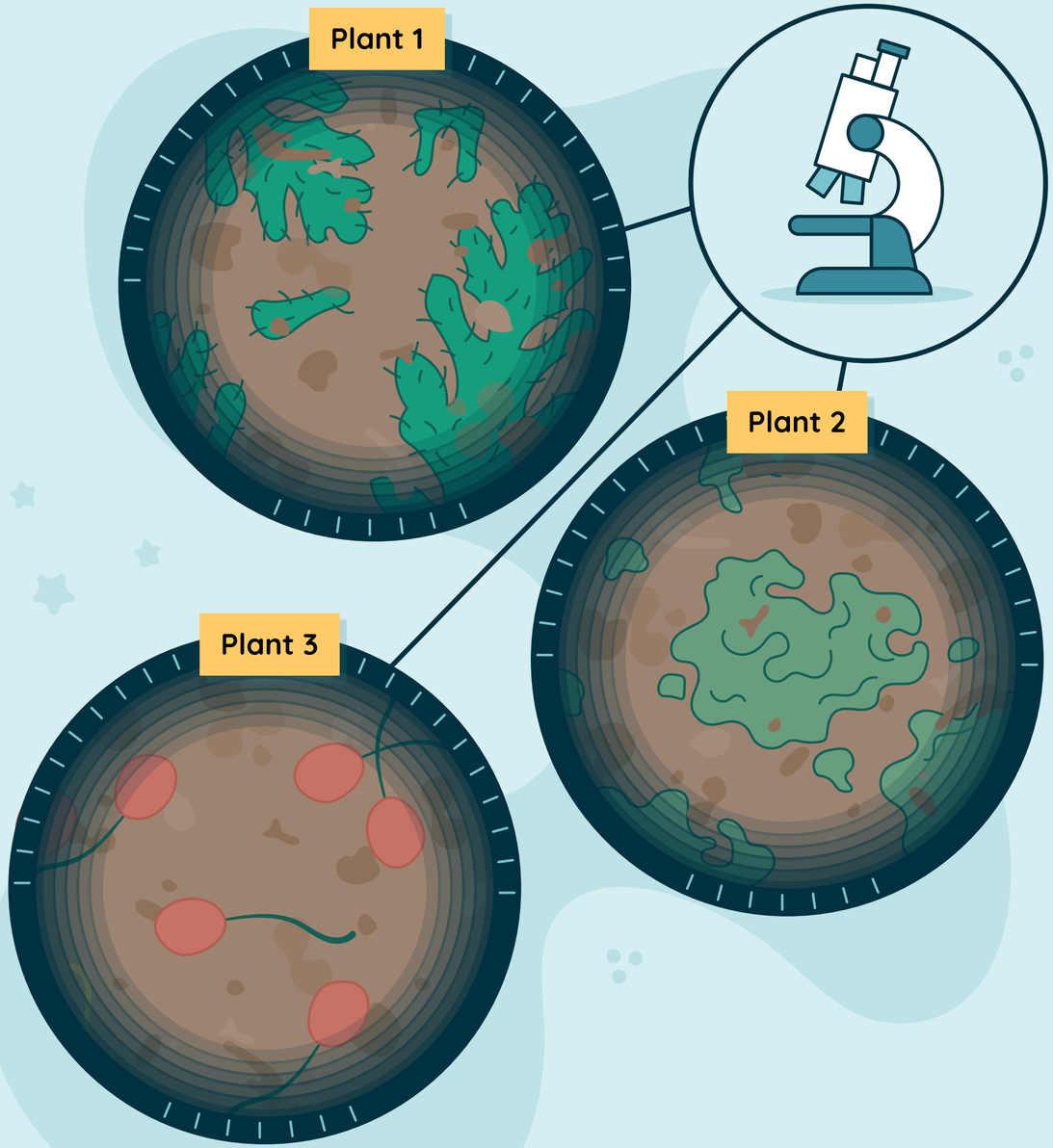
“When examining shoes, the inner layer may contain plants that the criminal stood on when they approached the crime scene. The middle layer, plants from the crime scene itself and the outer layer plants from their escape route.

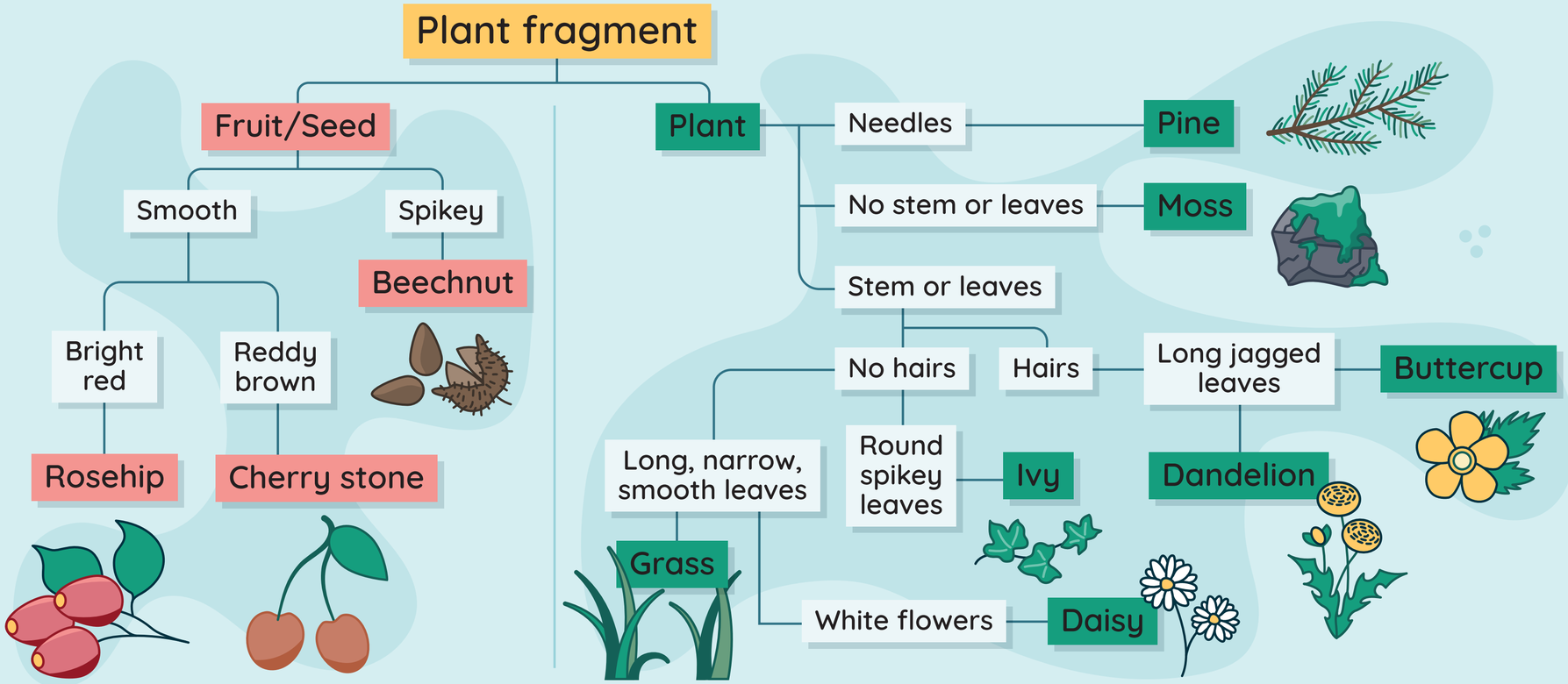
“Each layer may have different plants and can tell you what the crime scene looks like.”

“Your turn Ellie! Here’s the soil sample from Rusty’s paws. Use the microscope to find any plant fragments. This diagram will help you identify them, it’s called a ‘Dichotomous Key’.”

Dr Simpson also told Ellie that botanists often use a collection of known plants including their leaves, petals and seeds, to identify an unknown plant. This collection is called a ‘Herbarium’.

“The first plant has green jagged leaves and hairs. The second plant has no leaves. The third, is smooth, round, and a reddish-brown colour,” Ellie observed.





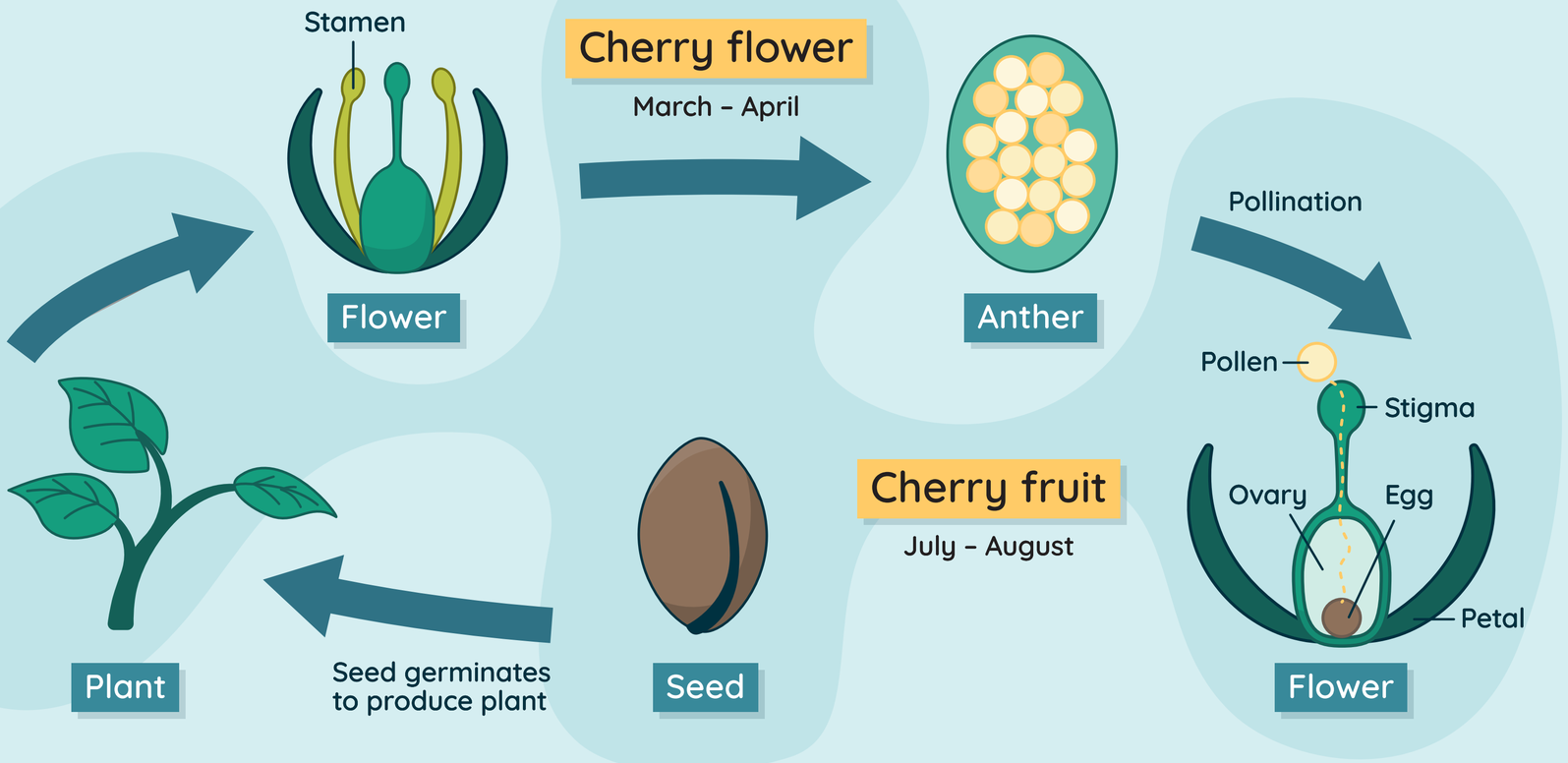
"Can you identify them?" asked Dr Simpson.

"I think it's a dandelion, moss and a Cherry stone," replied Ellie.

"So, what does this tell you about where the keys are buried in the back garden?" asked Dr Simpson.

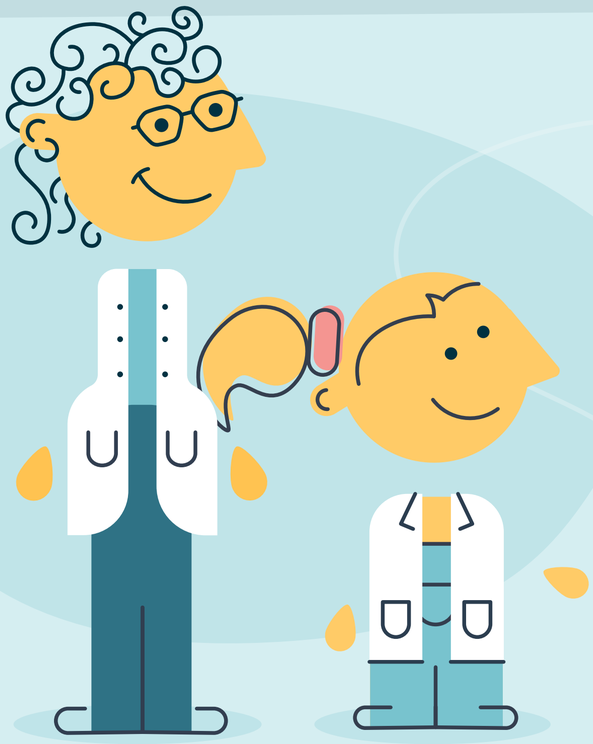
"It's part of the garden where dandelions and a Cherry tree grow. There's moss, so it's likely to be damp," suggested Ellie.

"The cherry stones give us another clue. If you look at the life cycle of the Cherry tree, cherries appear on the tree in August. Inside the cherry fruit are cherry stones. These stones are the seeds from which new plants will grow," continued Dr Simpson.



“Kai’s keys were stolen on 15th August. The Cherry stones tell us the soil on Rusty’s paws comes from a hole that was dug recently.

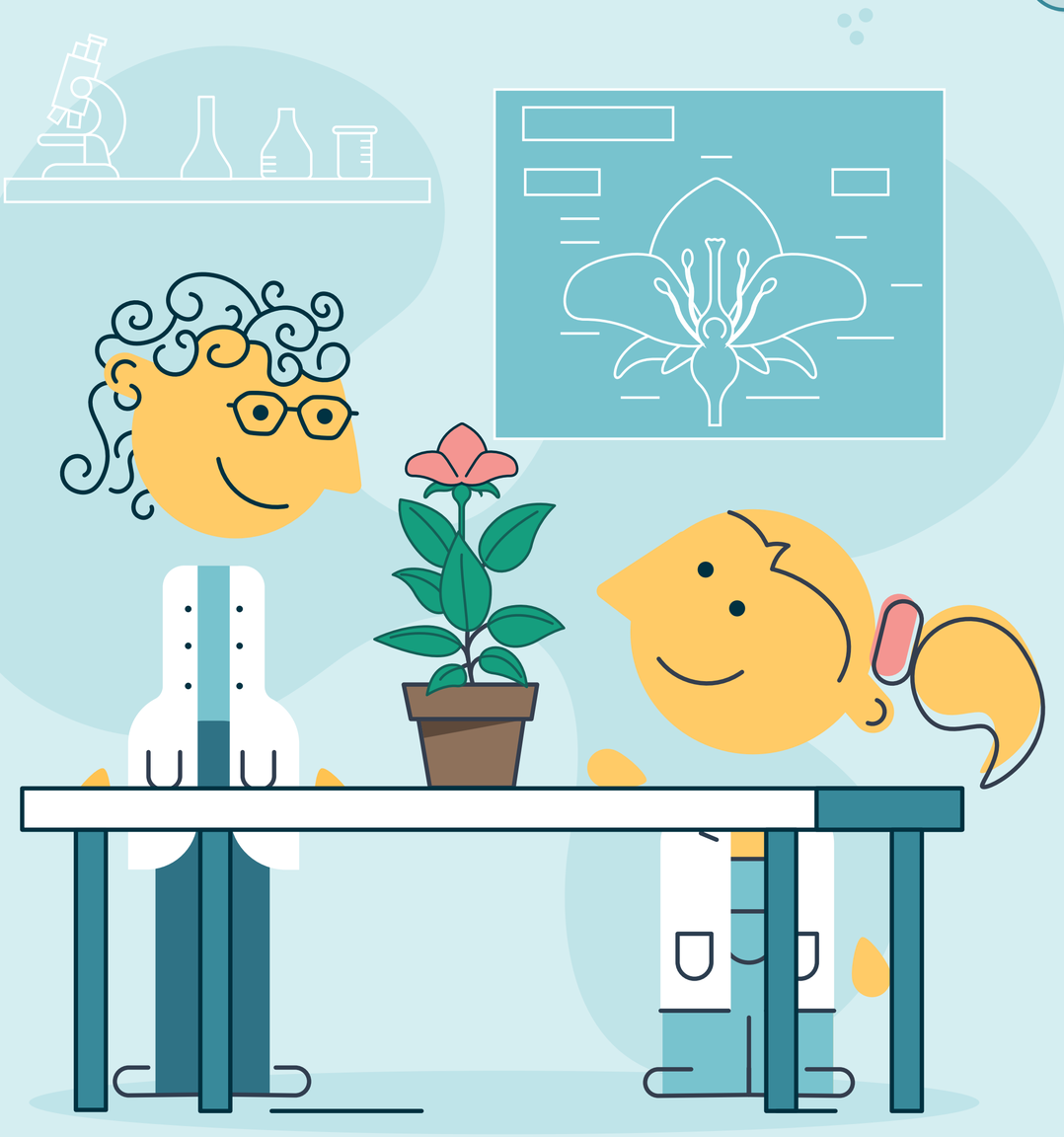
“Next, we can look at the pollen in the soil from Rusty’s paws and collar. It will give us more clues of where he has been digging.”

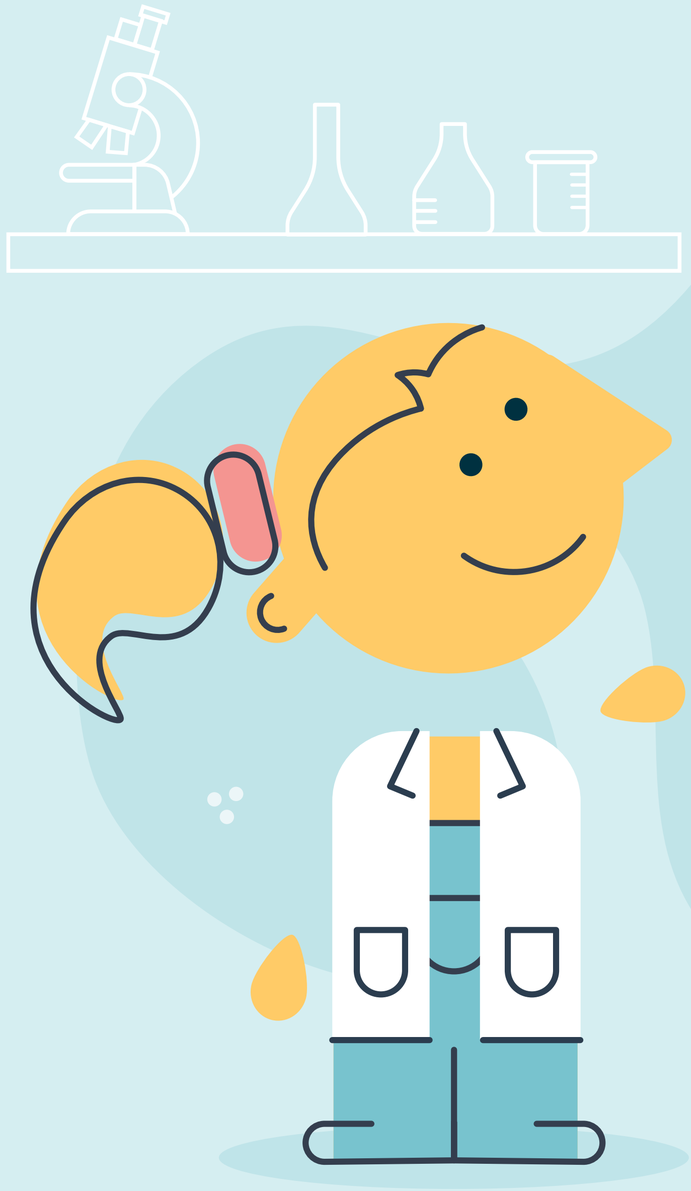


“Someone who uses pollen to solve crimes is called a Forensic Palynologist. Pollen is important to enable plants to reproduce.”

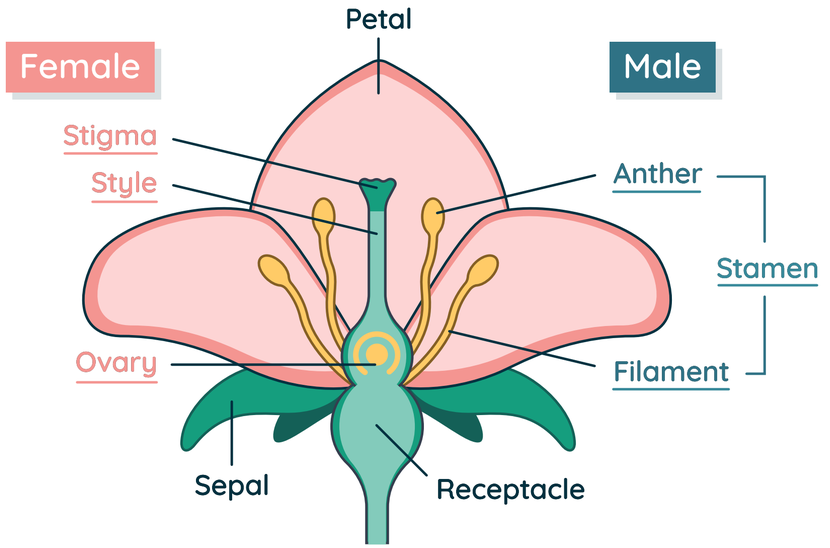
Dr Simpson cut up a plant for Ellie. “Can you show me the different parts of the plant? The petals, stigma, style, receptacle, ovary and stamen?” Ellie wrote labels for each.

“The stamen is made up of the anther and filament. The anther is full of pollen. This is the male part of the flower,” explained Dr Simpson. “Can you show me the female parts?”



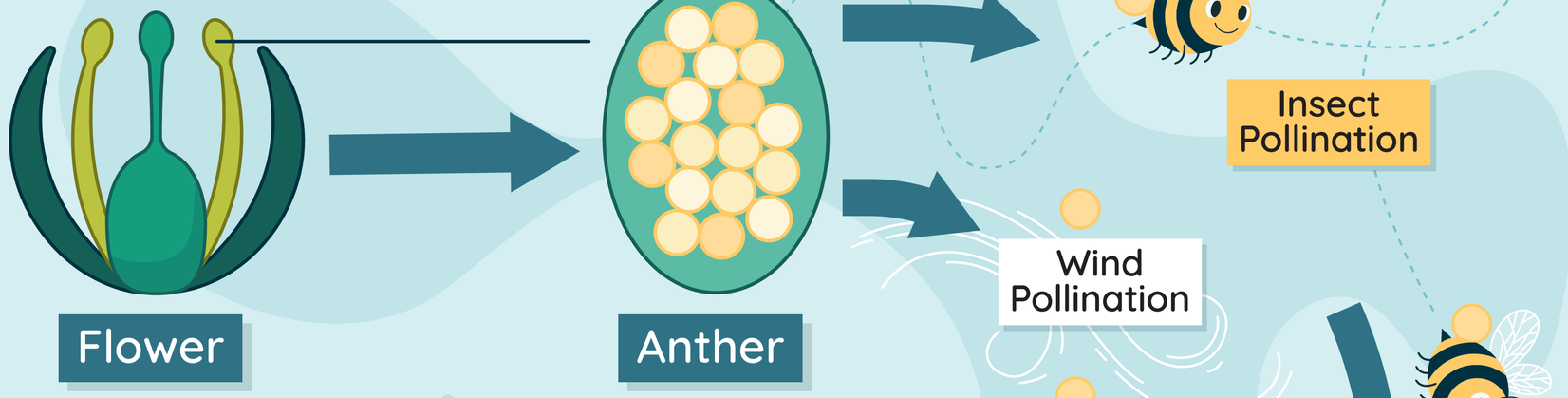


Plant structure



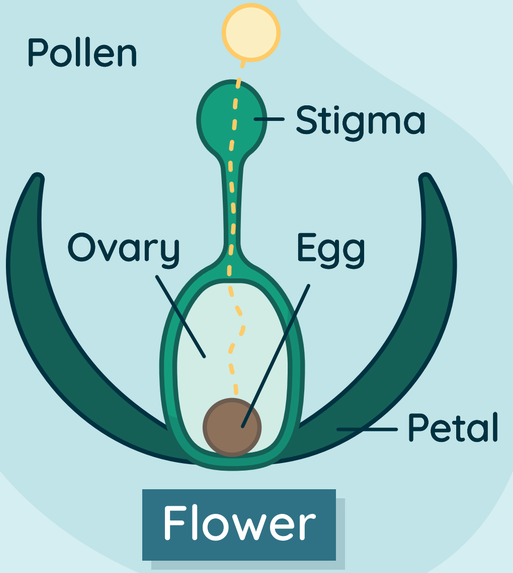
Ellie pointed to them.

“That’s right, the stigma, style and ovary.
To reproduce, pollen from one plant needs to reach the stigma of another plant. This is called pollination. Some plants though, will self-pollinate.”



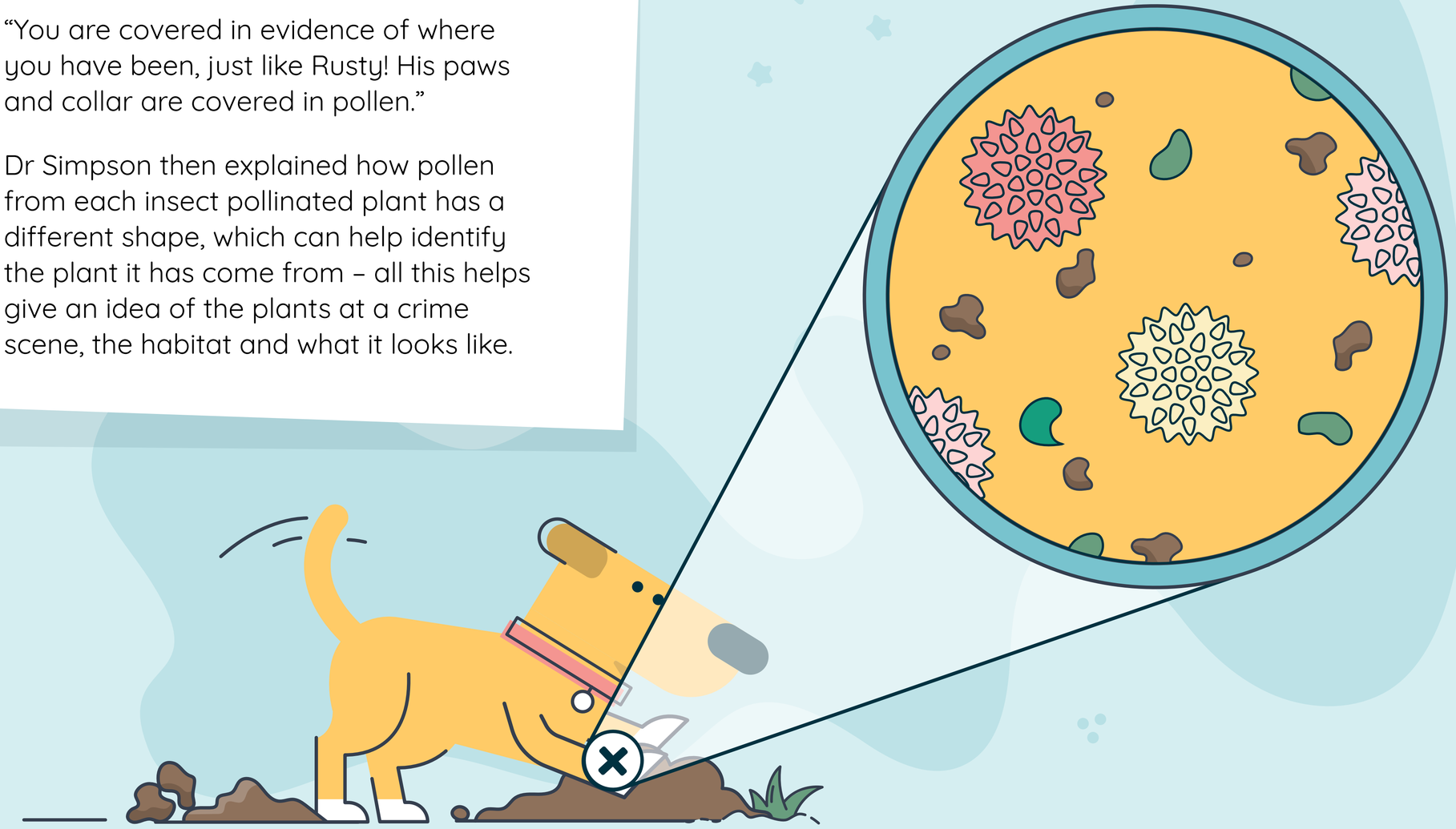
"Pollen is transferred from one plant to another by wind or insects. It's the insect pollinated plants which help to solve crimes!

"Pollen from these plants is sticky and heavy. It may fall directly onto the soil if dislodged, but it can't be carried in the air. Just like an insect, the only way you can get pollen on you, is if you brush against these plants. The pollen will stick to you, your clothing, car, shoes, or paws!"



“You are covered in evidence of where you have been, just like Rusty! His paws and collar are covered in pollen.”

Dr Simpson then explained how pollen from each insect pollinated plant has a different shape, which can help identify the plant it has come from – all this helps give an idea of the plants at a crime scene, the habitat and what it looks like.

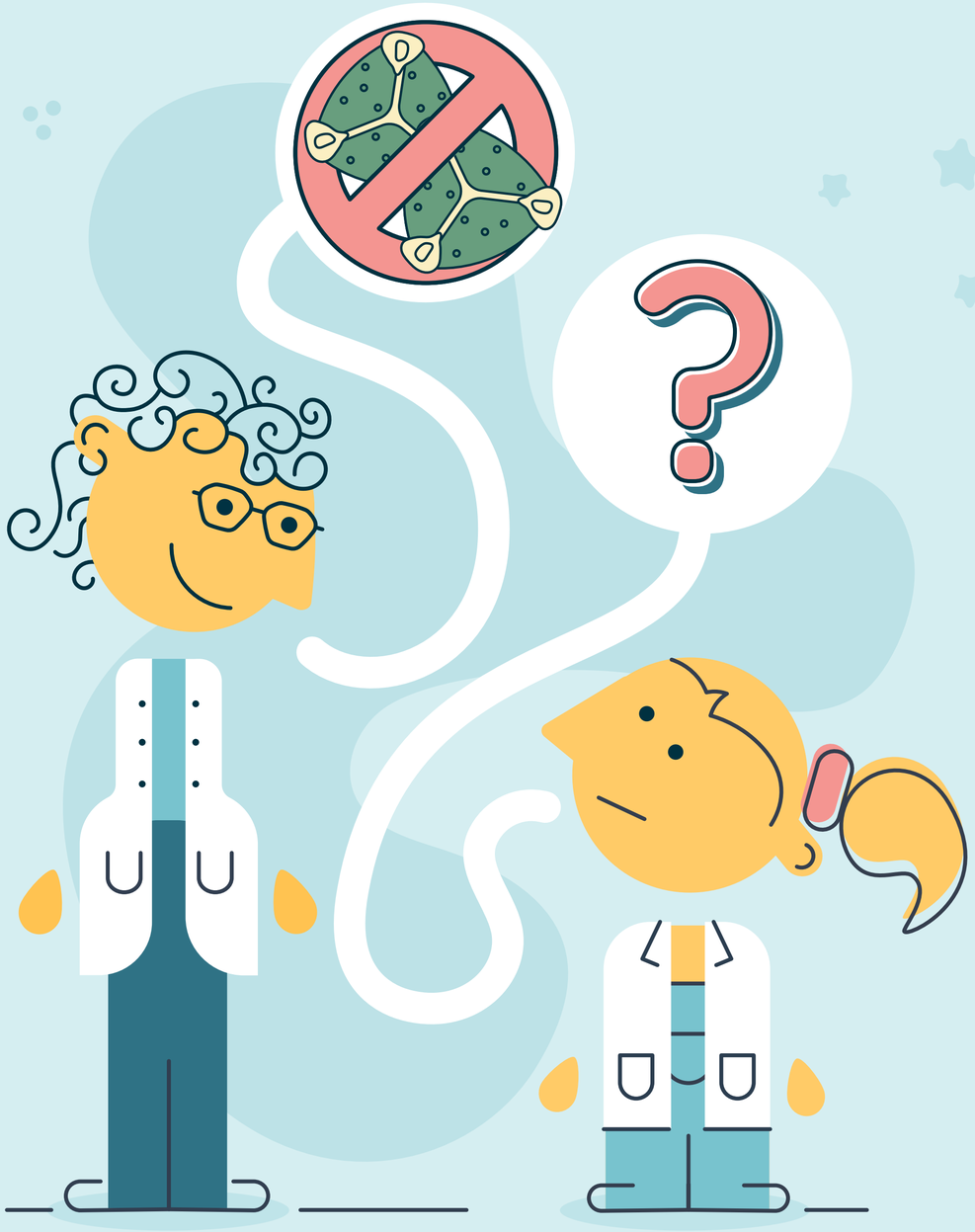


“Why won’t pollen from wind pollinated plants help?” asked Ellie.

“This pollen is light, with a smooth surface. It makes it aerodynamic, so it can easily be carried by the wind. But also makes it difficult to identify which plants the pollen comes from.

“The pollen may give you an idea of which plants make up the landscape in the wider area around the crime scene, but it could come from a large distance away, not the location itself. It could be misleading,” explained Dr Simpson.

“Not much help for finding Kai’s keys then!” remarked Ellie.



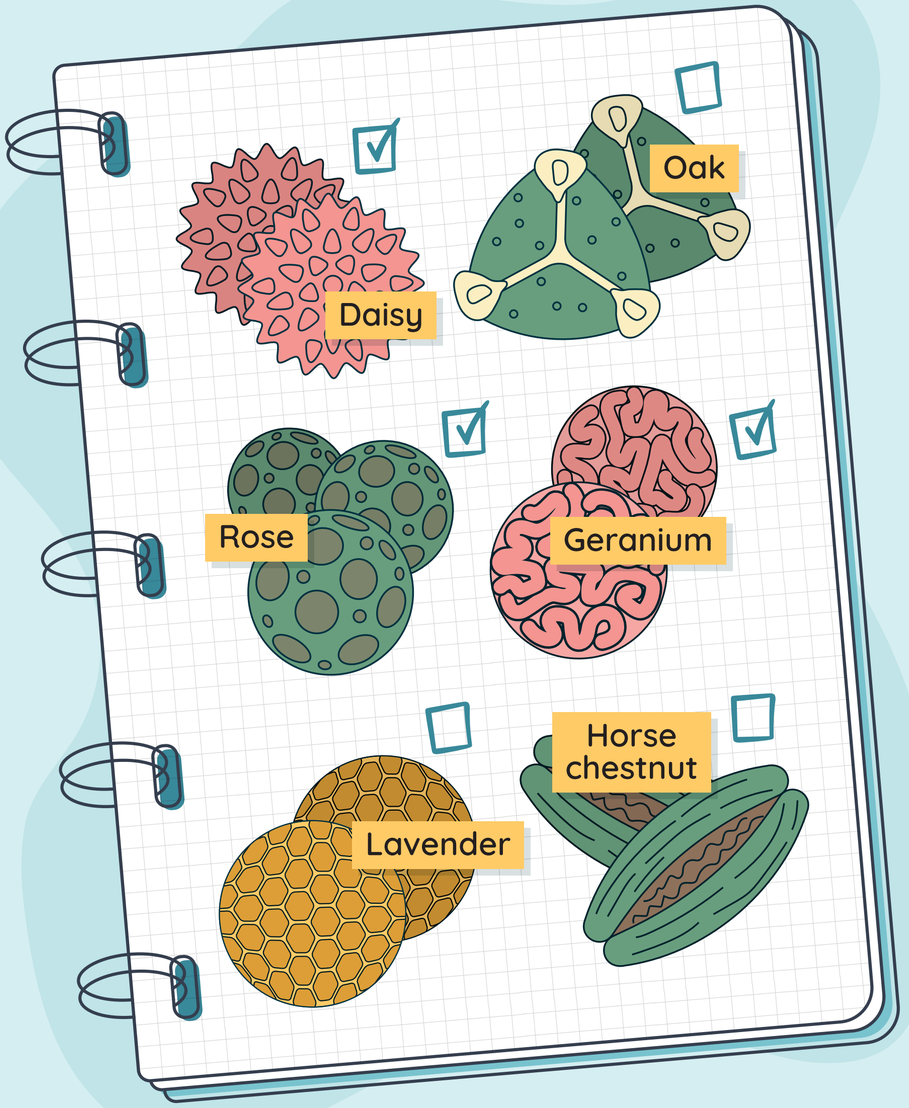
“Forensic Palynologists spend a long time looking at samples under the microscope to identify pollen.

“Here’s a pollen reference chart. Have a look at the soil from Rusty’s collar under the microscope. Can you identify which plants the pollen comes from?” asked Dr Simpson.

Ellie wrote the names of the plants into her notebook.

“Well done, Ellie. So, you are looking for a location in your back garden which has dandelions, moss, a Cherry tree, daisies, roses, and geraniums.”

“I know exactly where this is!” said Ellie.



Ellie showed Dr Simpson where she thought the keys were buried. It was the only place that matched all the results they had seen.

“We’re looking for signs of a disturbance and that Rusty has been there recently. It could be a hole, fresh soil on the surface, broken branches, or flattened grass,” instructed Dr Simpson.

Ellie grabbed Mags and they started looking.

“Sometimes, we take a sample of the soil with what looks like an apple corer. We can use it to tell if the layers of soil have been disturbed by digging.

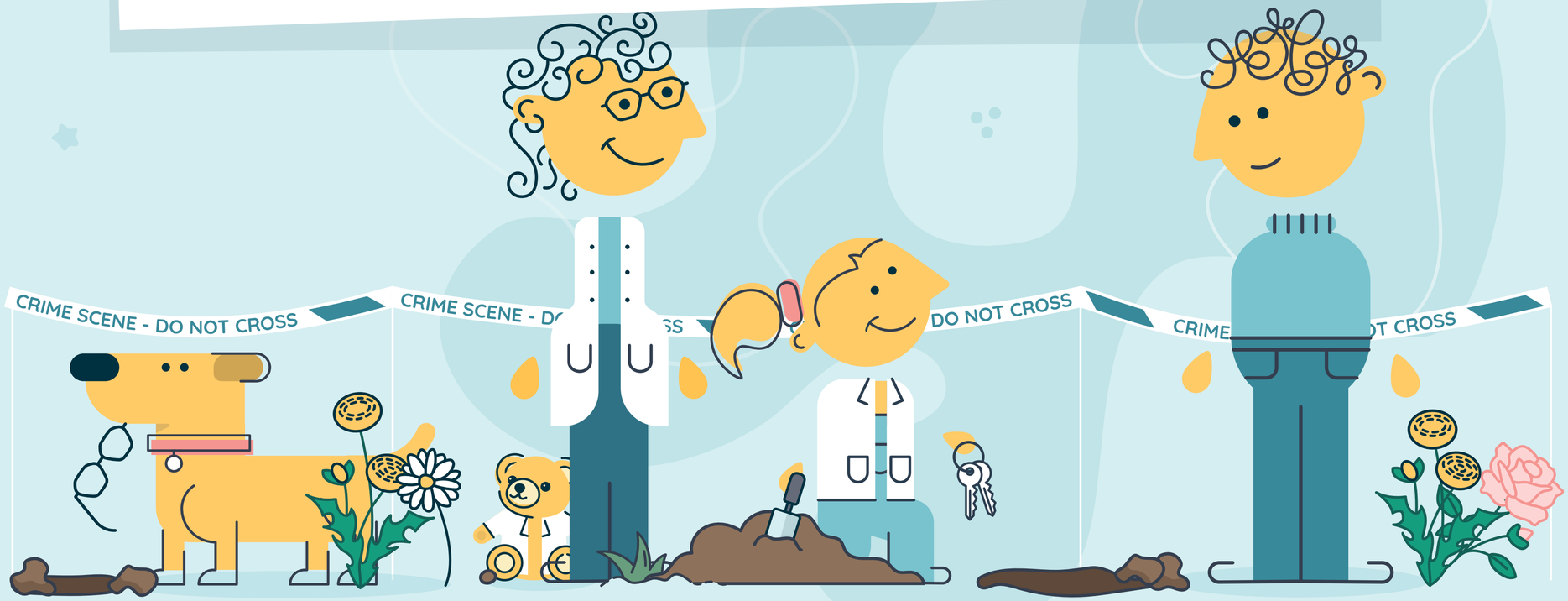
“You might get new plant growth, so it will look quite different from the surrounding areas, or you might see a bump on the surface.”

“A-ha!” exclaimed Ellie. “There are fresh scratch marks on the grass and soil from this hole. The geraniums have been dug up too. I’m going to dig here!”

Ellie reached her hand into the hole, while Mags, Kai and Dr Simpson looked on.

“Bingo! The keys! We solved the case!”

“Until the next time!” said Kai. They all laughed, as they could see Rusty at the top of the garden with a pair of glasses, digging yet another hole!



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Story by Dr Mandy Hartley

Geneticist, science educator and author of children's books