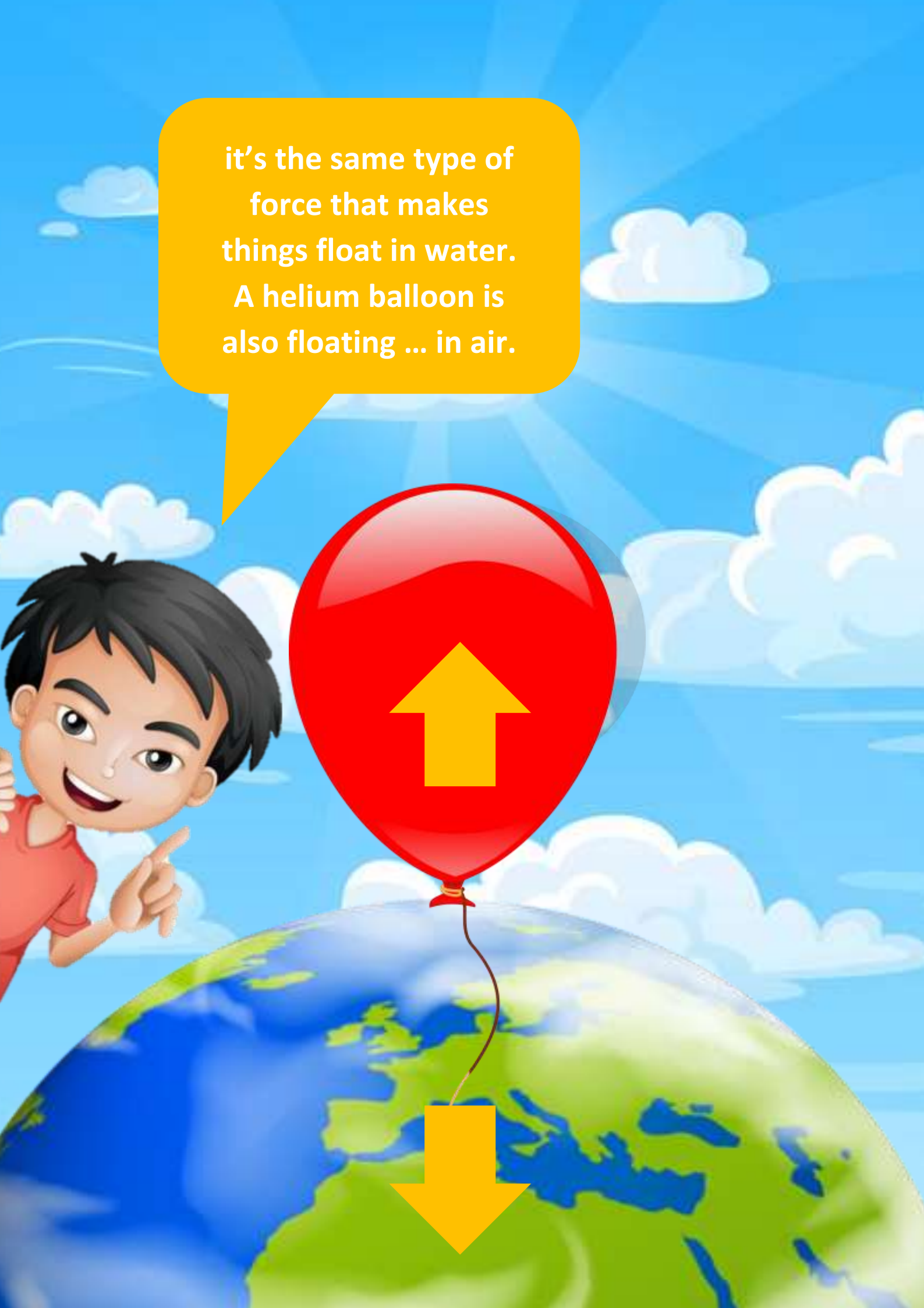
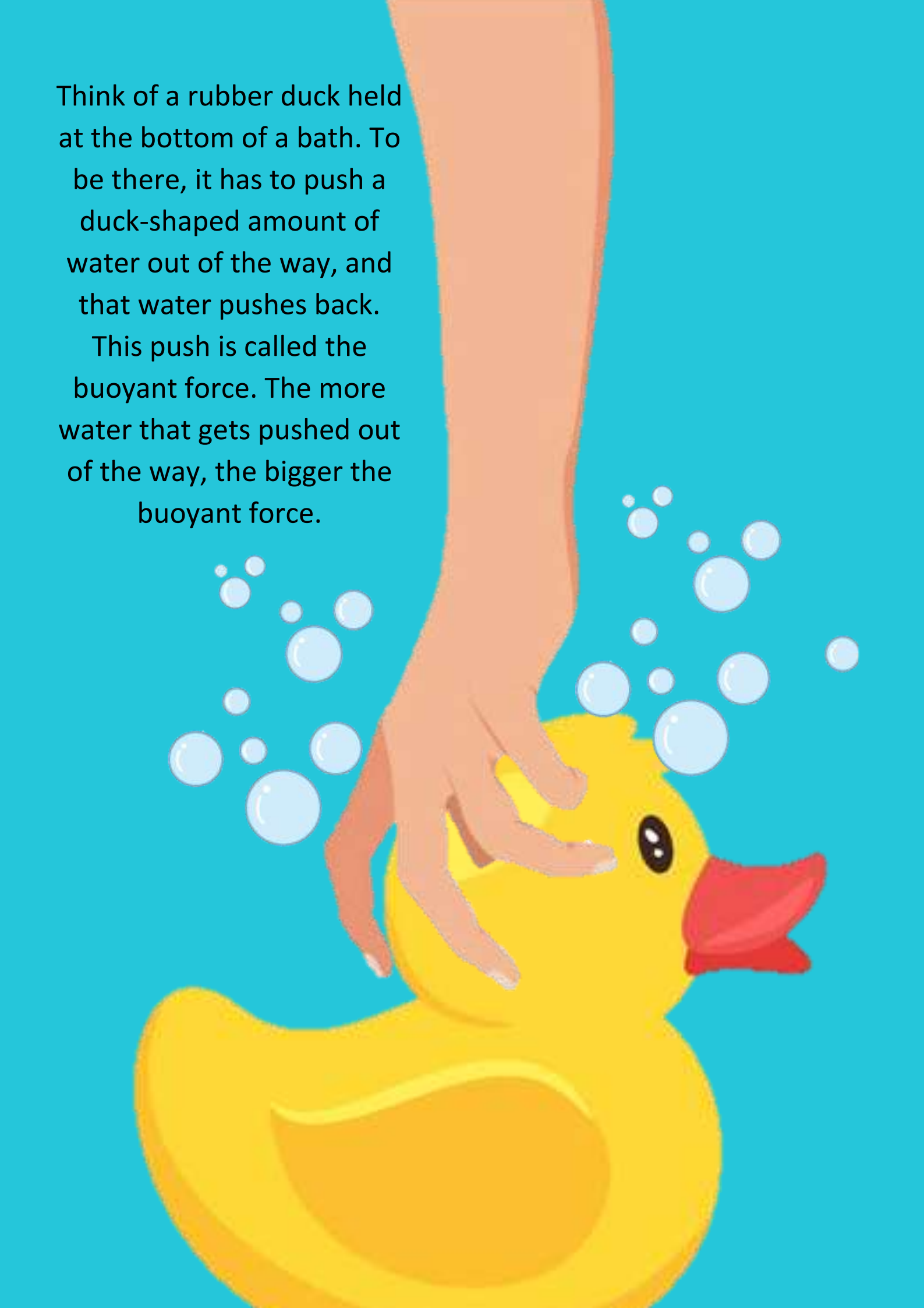

A Series of Impossible Questions
By Isabel Thomas
Why Doesn't Gravity Work on Balloons
THINK
DIGITAL ACADEMY

Most objects fall to the ground if you drop them, but some party balloons seem to follow different rules. If you let go of a helium-filled balloon it moves up.

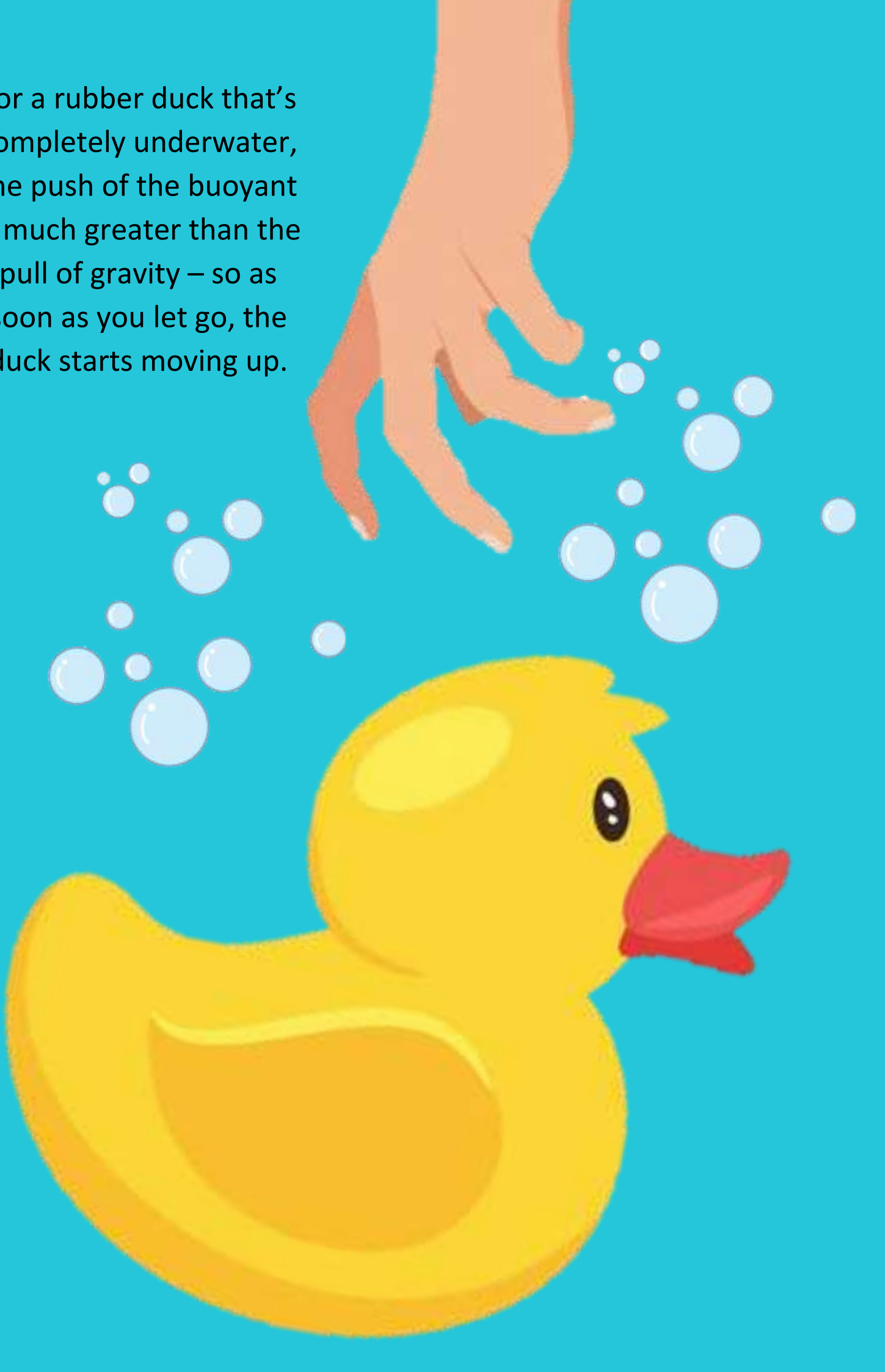

Earth’s gravitational force does work on helium balloons, pulling every particle down towards the ground. But this pull is cancelled out by another force pushing the balloon up.


it’s the same type of force that makes things float in water. A helium balloon is also floating … in air.

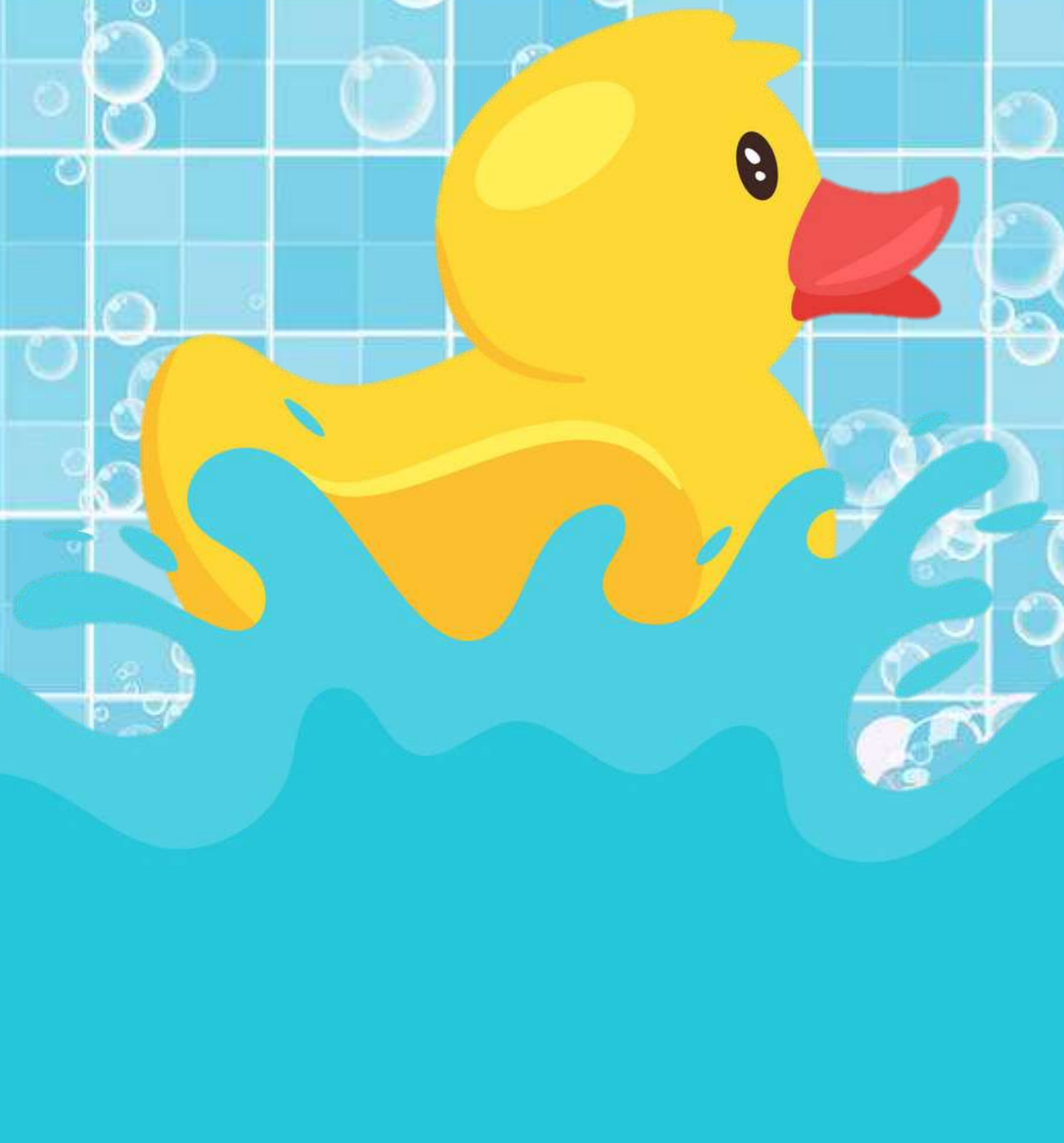
Think of a rubber duck held at the bottom of a bath. To be there, it has to push a duck-shaped amount of water out of the way, and that water pushes back. This push is called the buoyant force. The more water that gets pushed out of the way, the bigger the buoyant force.



For a rubber duck that's completely underwater, the push of the buoyant is much greater than the pull of gravity – so as soon as you let go, the duck starts moving up.



Once it reaches the surface, less of the duck is underwater so it's pushing less water out of the way. The buoyant force is now exactly the SAME SIZE as the downwards pull caused by gravity, the two forces cancel each other out and the duck floats.



We can predict which objects will float, rather than sink – it's the ones that weigh less than the amount of water they push out of the way. An air-filled rubber duck weighs less than a rubber-duck shaped of water, so it will float.

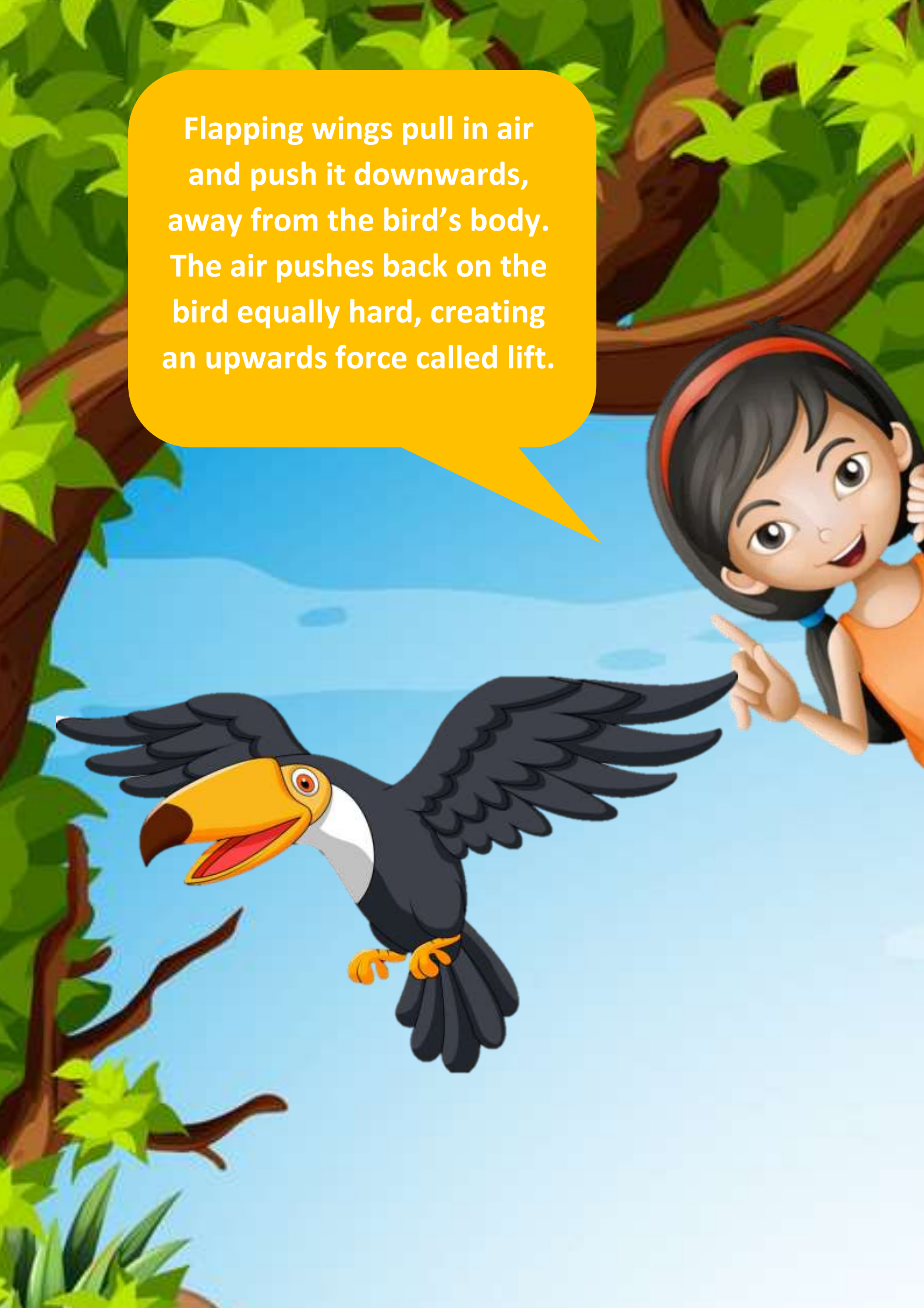
Similarly, the gas helium is far lighter than air, so a helium-filled balloon weighs less than the air it pushes out of the way. This means the buoyant force of the air is big enough to overcome the force of gravity and push the balloon upwards.

Just like the duck in the bath, a helium balloon will keep moving up until the air around it becomes so thin, the weight of the air pushed aside by the balloon matches the weight of the balloon – or until the balloon pops!

This usually happens first because party balloons tend to pop at around 10 km above Earth's surface. The helium escapes and keeps moving up, but gravity will pull the empty balloon back down, down, down to Earth.


Can Birds Fly to Space if They Want?

Birds don’t float in air like balloons. They overcome the pull of gravity with a different kind of push.

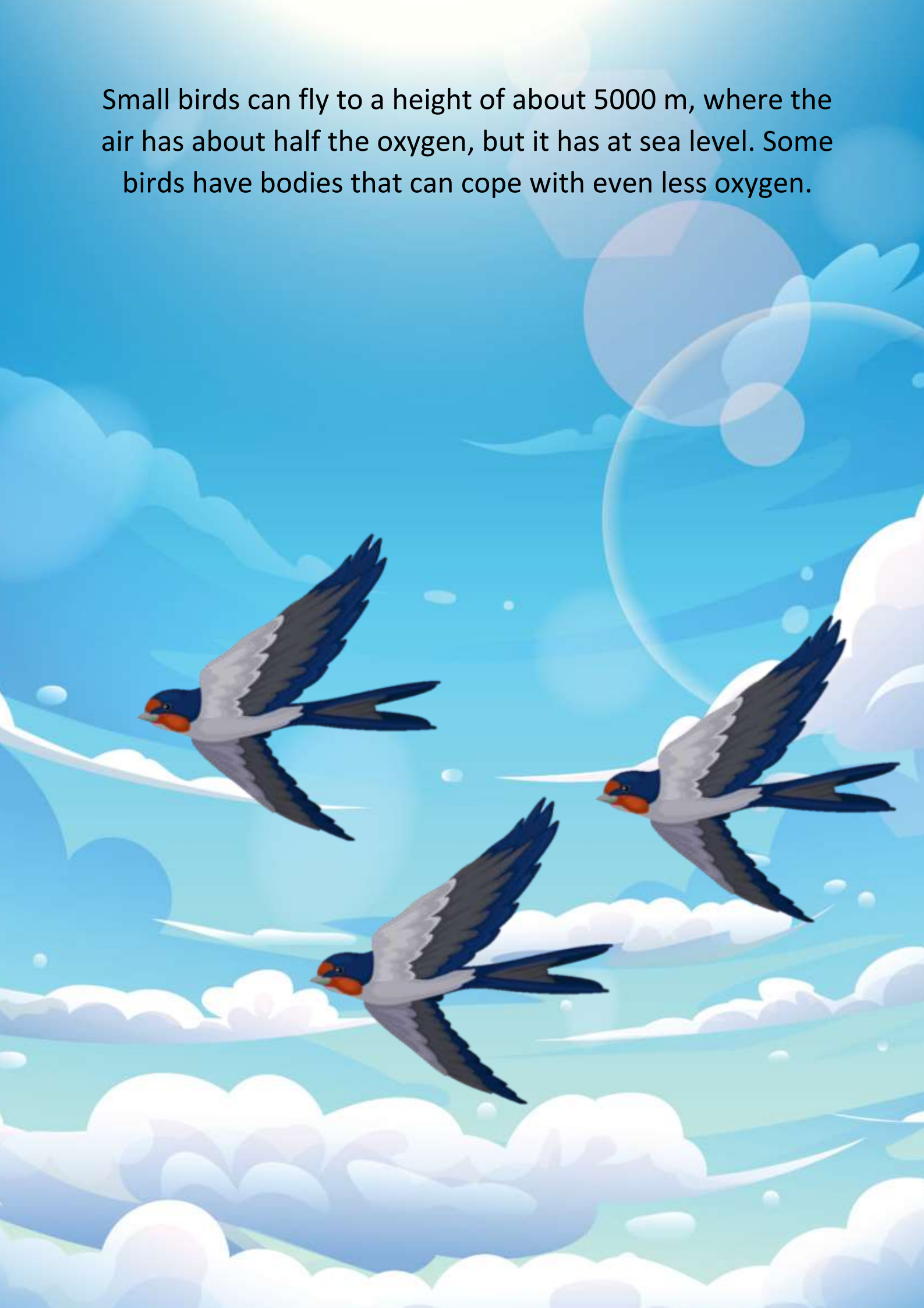

Flapping wings pull in air and push it downwards, away from the bird's body. The air pushes back on the bird equally hard, creating an upwards force called lift.


The bigger the bird, the bigger the wings needed to produce the right amount of lift to overcome gravity.

Some birds use a different trick to create lift. They open very long wings over rising warm air, which pushes them upwards. But even gigantic wings couldn’t carry a bird all the way into space.

The higher you get above Earth’s surface, the thinner the air, which means there is less oxygen to breathe.

Small birds can fly to a height of about 5000 m, where the air has about half the oxygen, but it has at sea level. Some birds have bodies that can cope with even less oxygen.



A Ruppell’s griffon vulture has been spotted more than 11 km up! but even if one of these high-flying vultures wore a tiny spacesuit (with room for a break), it still couldn’t flap its way up into space. Soon the air becomes so thin that it’s impossible to generate lift.

So a Ruppell's griffon vulture may be able to peer into the window of a jumbo jet, but it's still a long way from being an astronaut. Space officially starts ten times further up, 100 km off the ground.

How Do Aeroplanes Fly?

This question has proved impossible to answer for more than 100 years. Engineers have designed planes that can loop the loop, aircraft with a wingspan as long as a football pitch, and jumbo jets with room for 850 passengers at once.

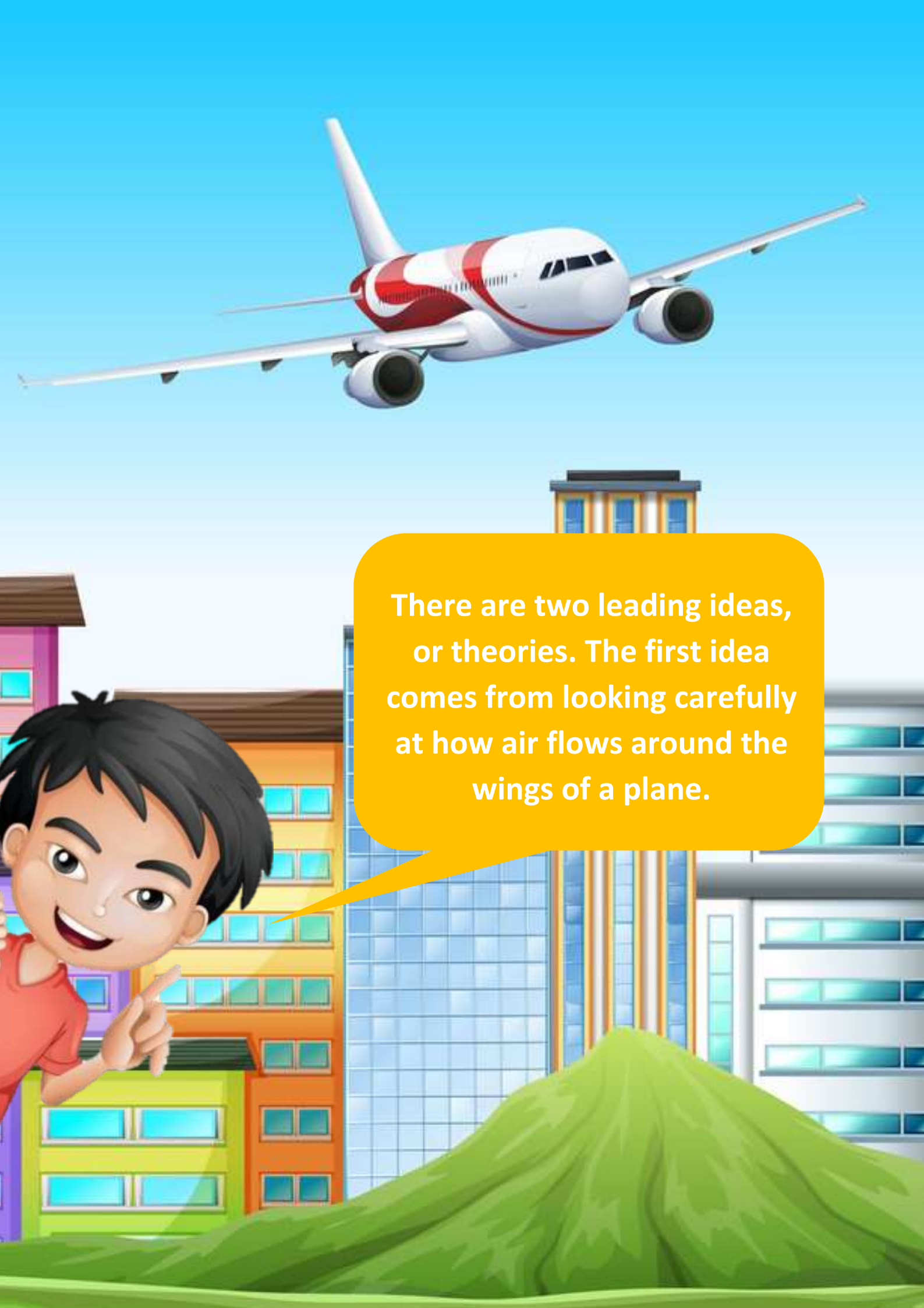

But they still disagree about exactly HOW these planes stay up in the air.

Here are the things we do know:

- Air needs to move around the wings for an aeroplane to fly.
- This means a plane has to be moving quickly to take off and stay up in the air – the engines provide this forwards force, called thrust.
- The special curved shape of the wings is important (it even has a name – an aerofoil).
- An upwards force called lift cancels out the downwards force cause by gravity.

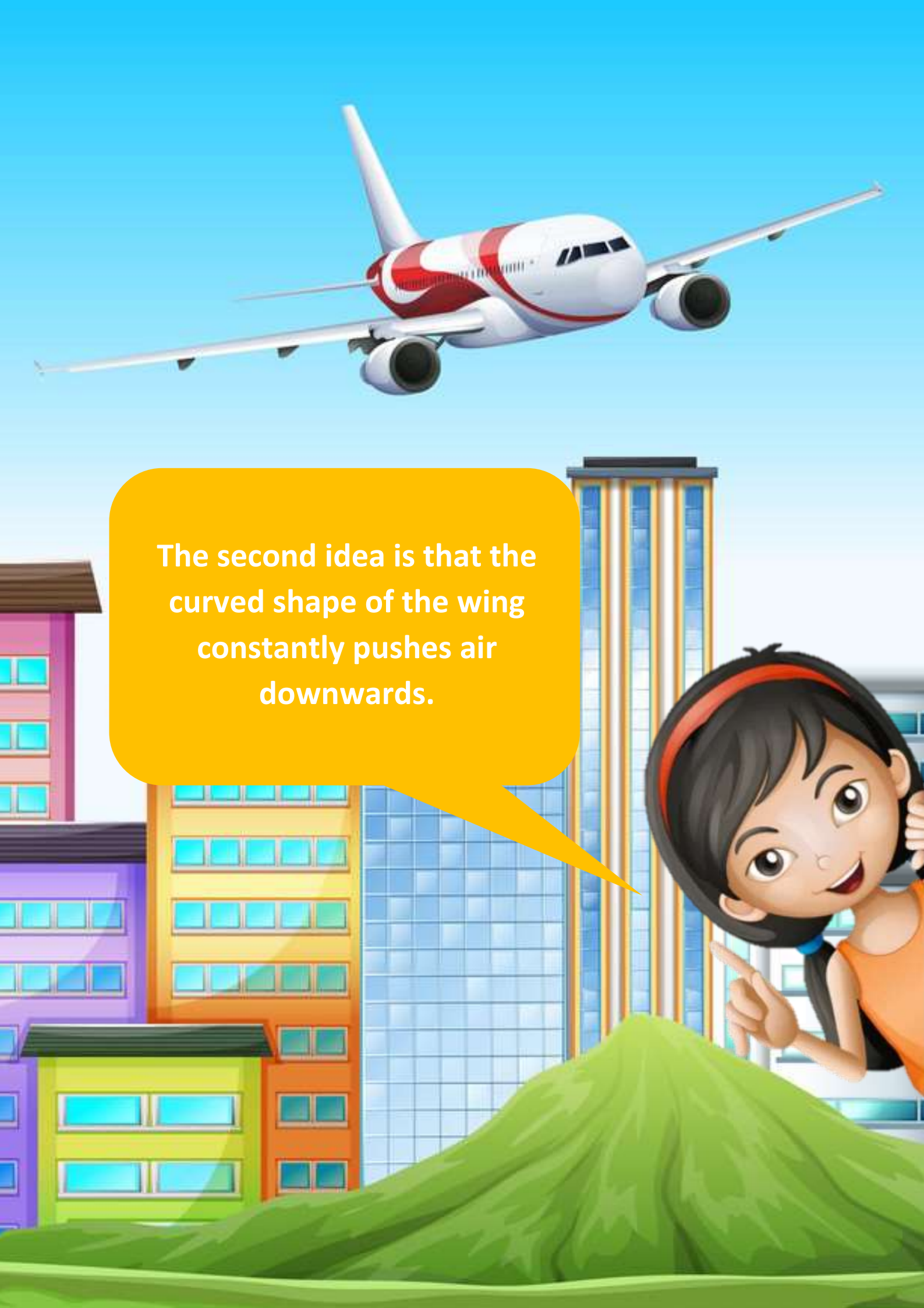
Here are the things we don’t know:

- Where this lift comes from!

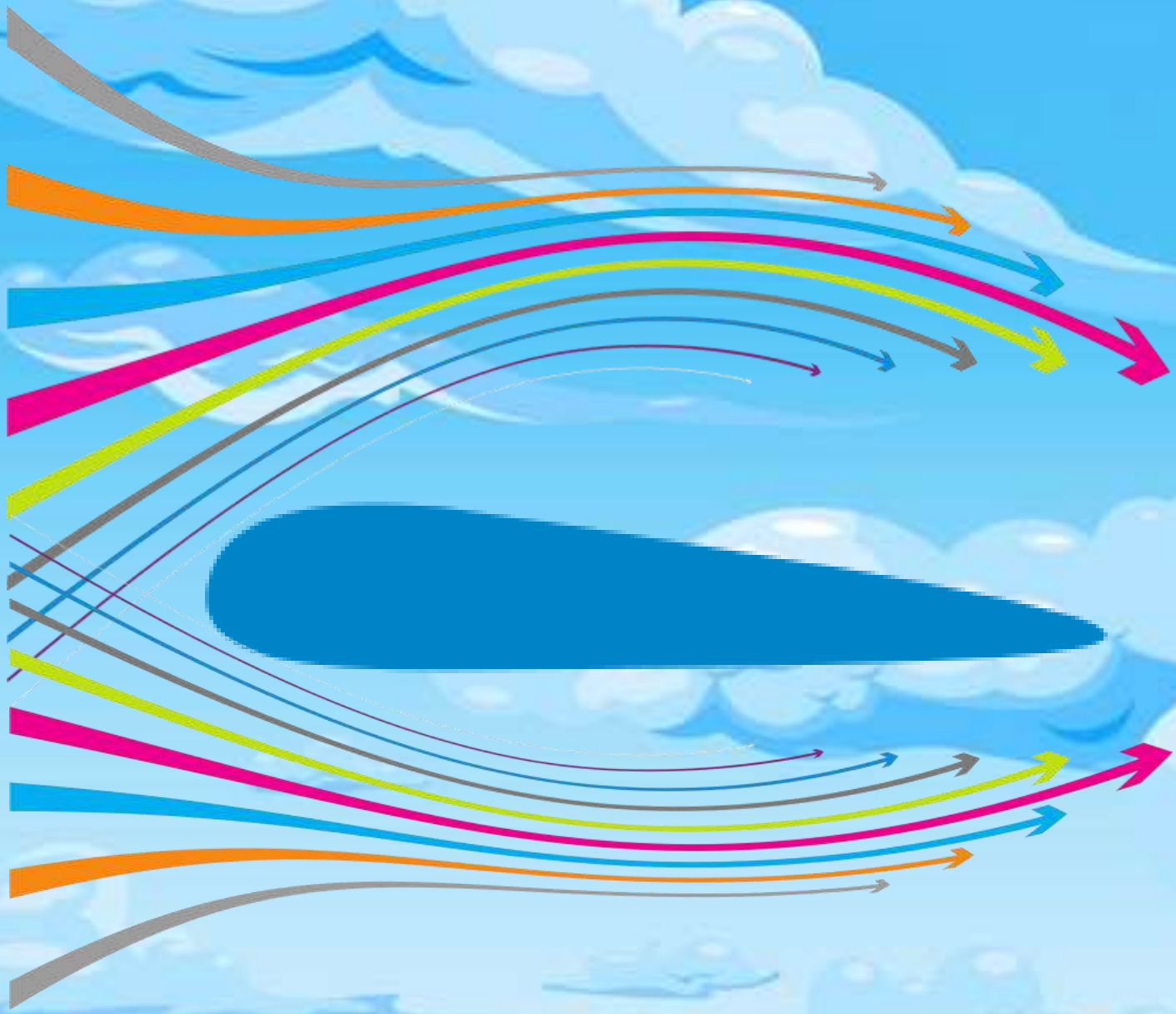

There are two leading ideas, or theories. The first idea comes from looking carefully at how air flows around the wings of a plane.

We can see that air moves faster over the top of the wing than the bottom. It's also more spread out than the air below the wing.

Perhaps the bunched-up air underneath presses harder on the bottom of the wing than the spread-out air on top, and the difference is what creates the LIFT that makes a plane go up and stay up! However, this can't explain why some planes can fly perfectly well upside down.


The second idea is that the curved shape of the wing constantly pushes air downwards.

The air pushes back and so the wing (and the plane attached to it) are pushed up. This is a bit like the upwards push people feel if they hold their hand out of a car window when they're whizzing along. However, this CAN'T explain why the air is more spread out of the wing, or the effect this has.



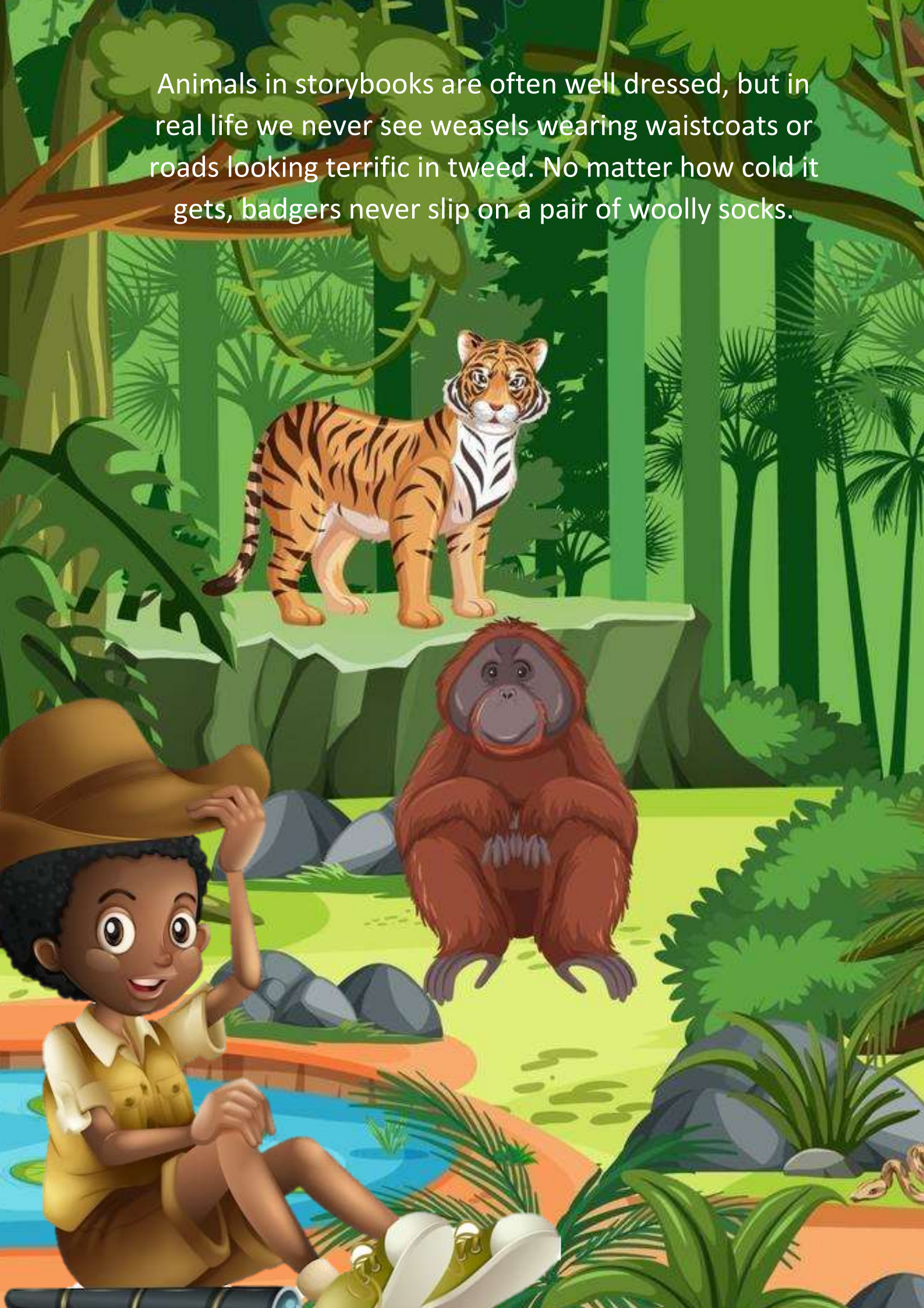
Each idea is good, but neither can completely explain lift on its own. The answer is probably a mixture of all these things: the downwards flow of air, the speed of ait above the wing, AND the difference in pressure.

So until someone works out how to combine all these things into one neat explanation, the puzzle of how some of the world's heaviest vehicles stay up in the sky remains impossible to solve.

Overcoming gravity is only half the problem – a plane also needs to overcome drag, a force that slows moving objects down as they rub against the air.

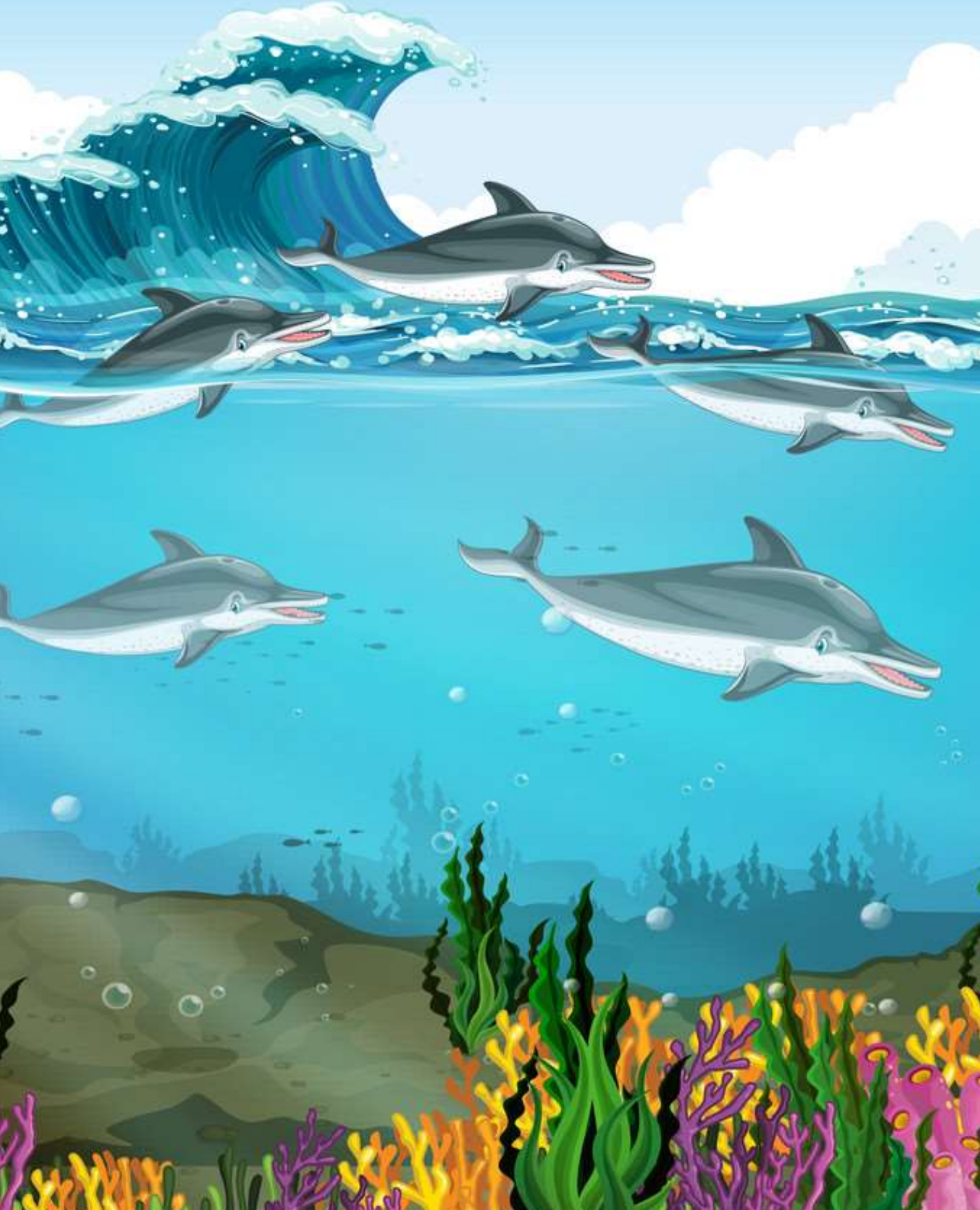
Engineers try to make drag as small as possible by giving aeroplanes a smooth shape, but they still gobble up huge amounts of fuel to keep flying fast enough to generate lift.


Why Don’t Animals Wear Clothes?


Animals in storybooks are often well dressed, but in real life we never see weasels wearing waistcoats or roads looking terrific in tweed. No matter how cold it gets, badgers never slip on a pair of woolly socks.

At first glance, humans seem to be the only animals that wear clothes. It’s impossible to keep them warm, as they gradually lost the fur that covers other mammals.

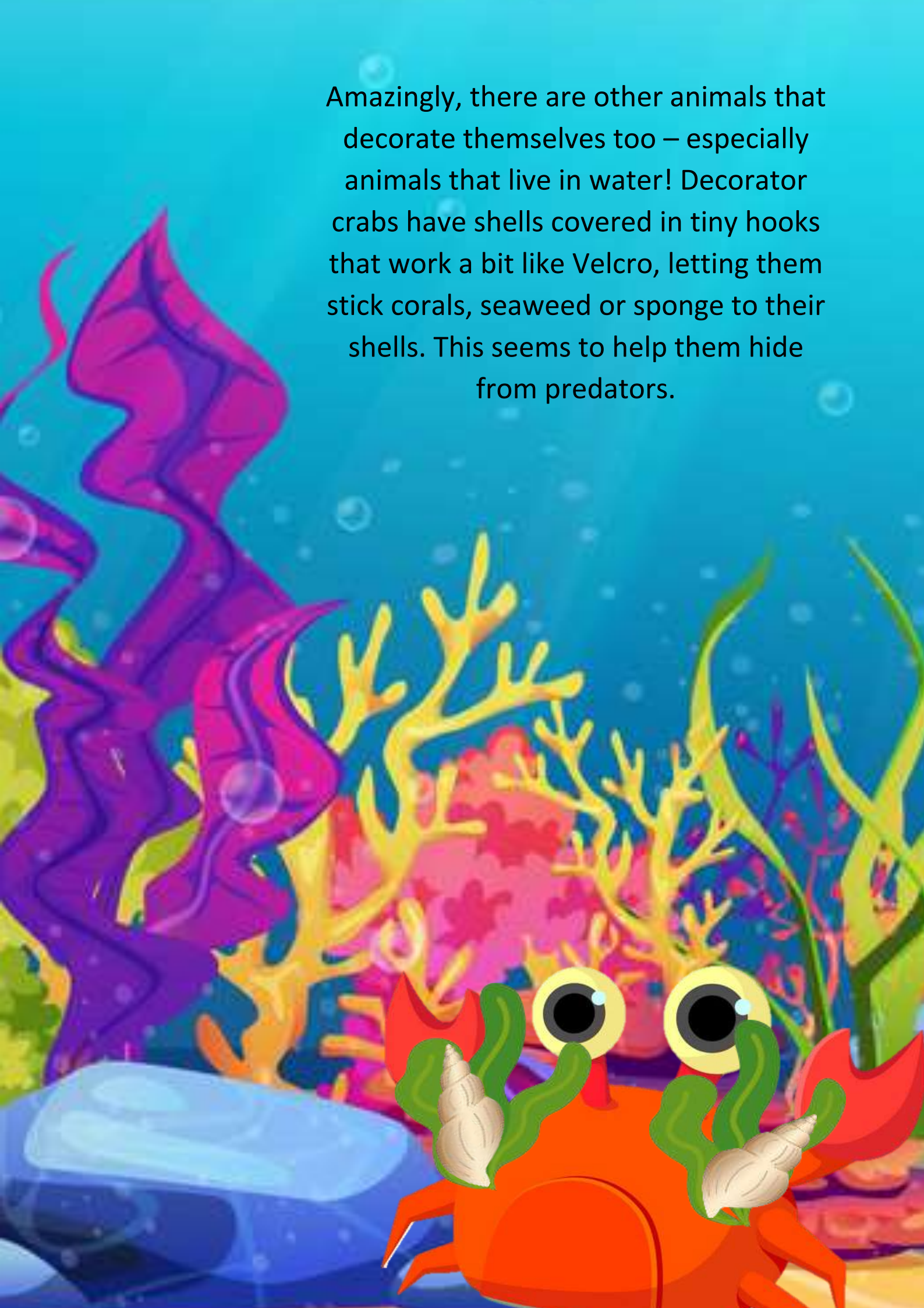
But dolphins don’t have much fur either and you’ll never spot one of them in a wetsuit.



Another idea is that clothes allowed humans to migrate from Africa, where the first human lived, to colder parts of the world. But clothes do much more than simply keeping us warm or dry.

We use clothes to tell other people something about ourselves – which groups or teams we belong to, which music, films and fashions we like, or even how we are feeling.

Amazingly, there are other animals that decorate themselves too – especially animals that live in water! Decorator crabs have shells covered in tiny hooks that work a bit like Velcro, letting them stick corals, seaweed or sponge to their shells. This seems to help them hide from predators.

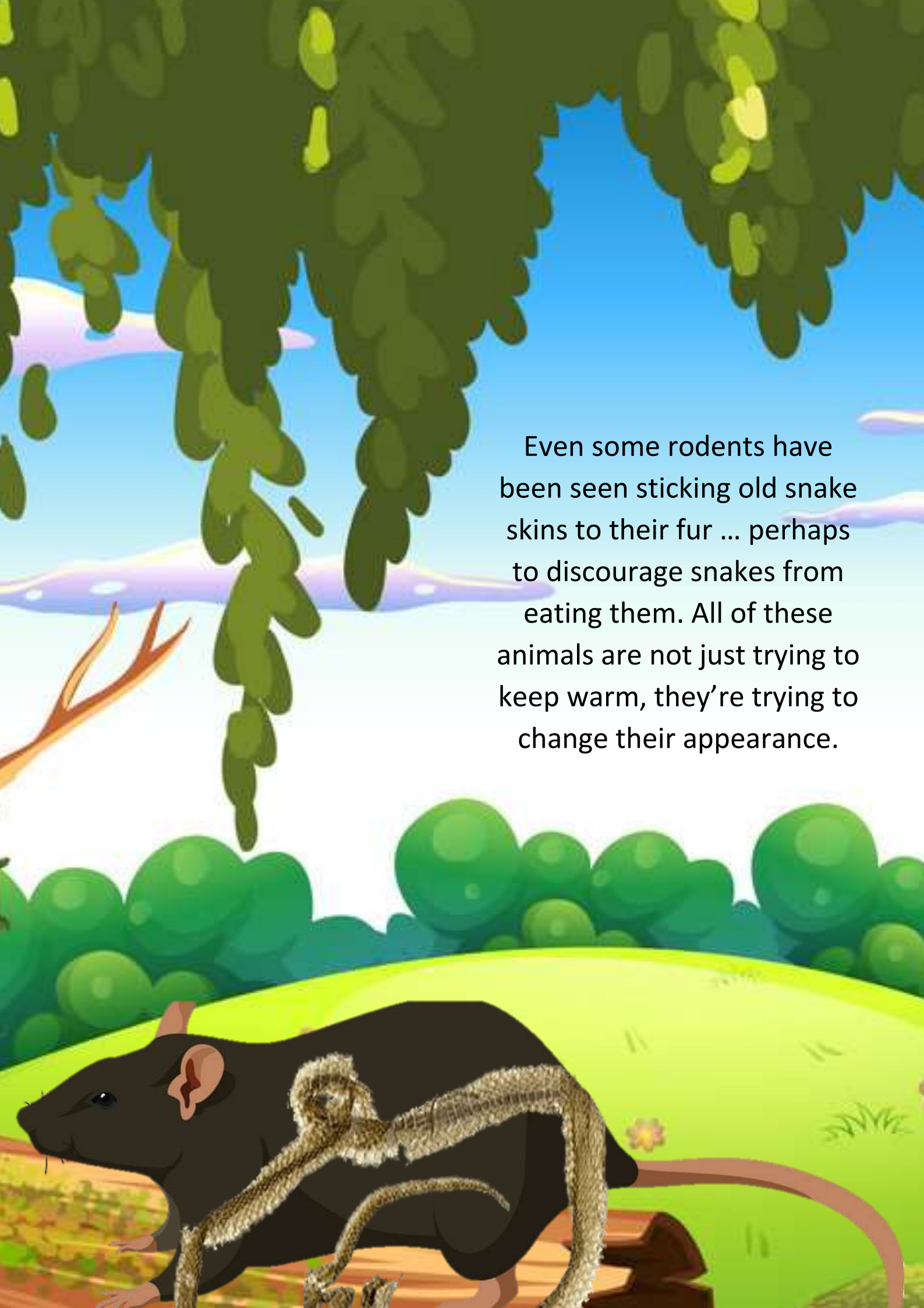


Some hermit crabs even accessorize with sea anemones to stop themselves getting attacked!

Sea urchins also cover themselves with rocks, shells and scraps of seaweed, perhaps to protect themselves from the Sun, just as we would put on a T-shirt to play on the beach.

On land, tiny insects called lacewings dress themselves up in a mixture of their own droppings, and a waxy ‘wool’ made from the bodies of aphids. This gruesome costume seems to shield them from attacks by wasps, ladybirds and ants.

Assassin bugs sometimes carry a backpack made from dead ants, which makes them look less delicious to spiders, geckos and centipedes.



Even some rodents have been seen sticking old snake skins to their fur … perhaps to discourage snakes from eating them. All of these animals are not just trying to keep warm, they're trying to change their appearance.


This is a big clue about why humans wear clothes. Luckily, we can choose trousers, dresses and T-shirts rather than dead insects or animal droppings.

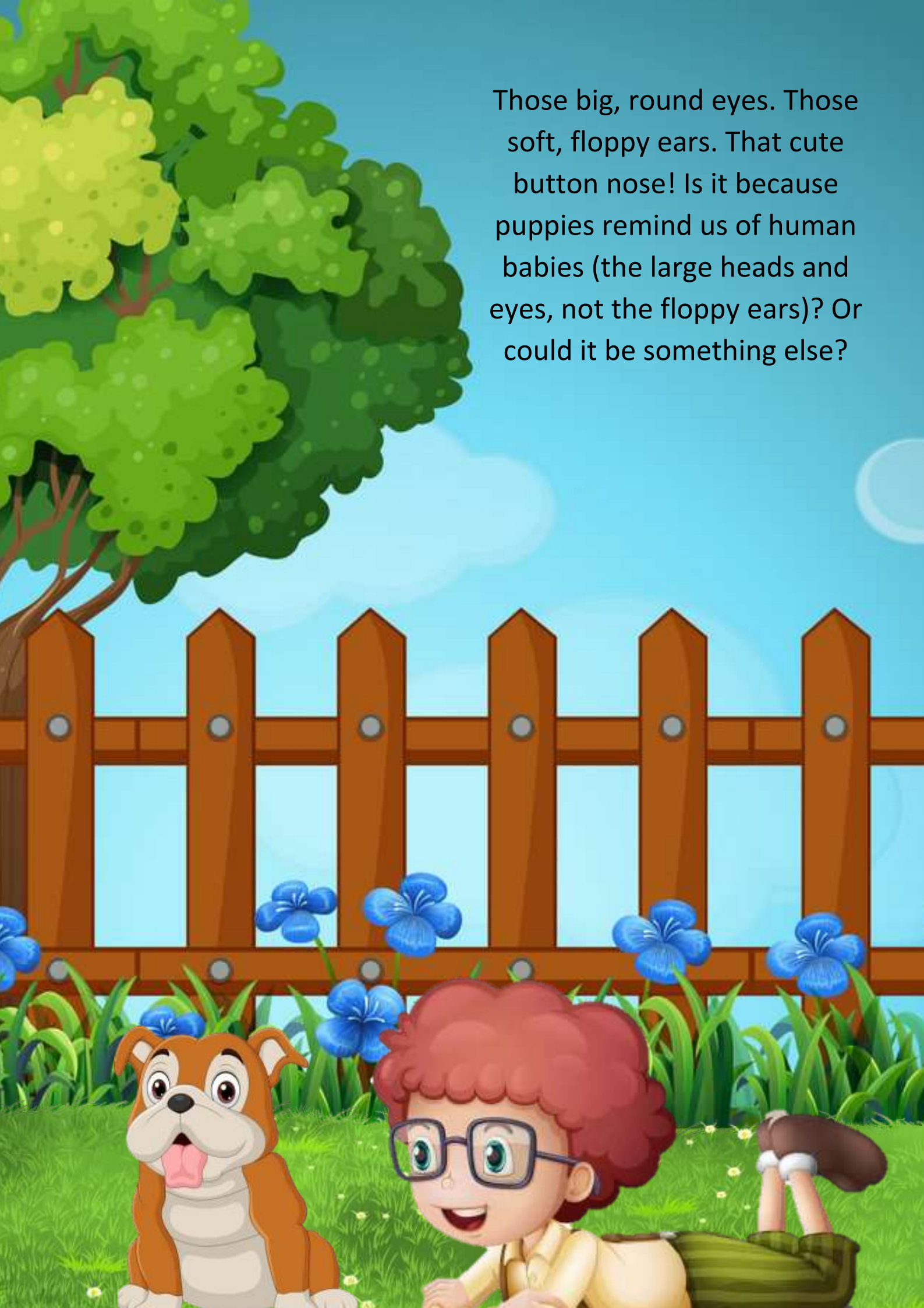
Why are Puppies Cute?

Some animals, such as snakes, never meet their offspring.

Others spend months or even years looking after their young. Scientists think that cuteness may be a feature of baby animals in the second group.

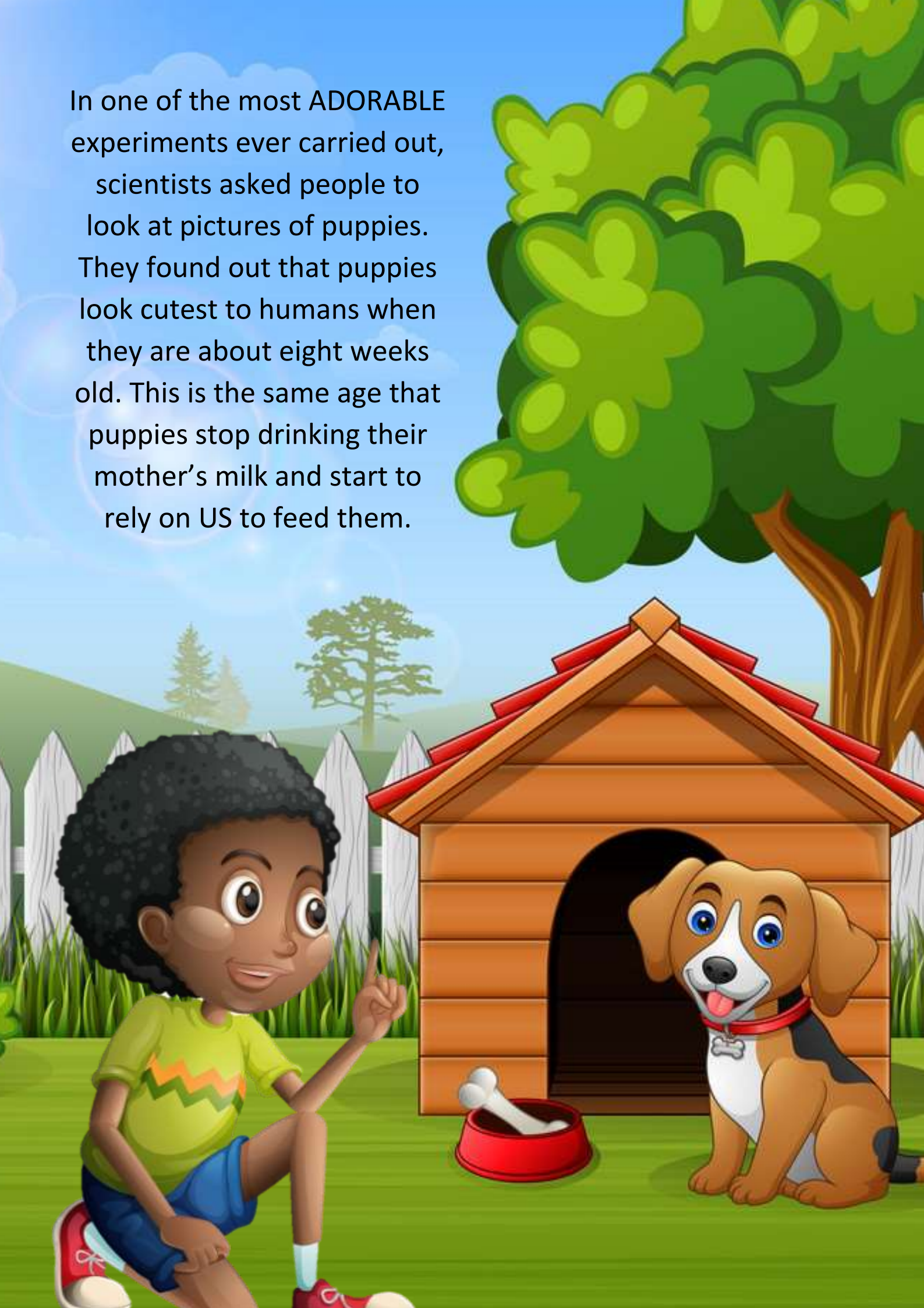
Fossils show us that even certain baby dinosaurs had big eyes and huge heads compared to their body size. Cute looks may help to make animal parents think “I want to look after you” instead of “I want to eat you!”

But when it comes to puppies it’s not just other dogs that find them adorable – plenty of humans do too!



Those big, round eyes. Those soft, floppy ears. That cute button nose! Is it because puppies remind us of human babies (the large heads and eyes, not the floppy ears)? Or could it be something else?

In one of the most ADORABLE experiments ever carried out, scientists asked people to look at pictures of puppies. They found out that puppies look cutest to humans when they are about eight weeks old. This is the same age that puppies stop drinking their mother's milk and start to rely on US to feed them.



Perhaps puppies have adapted to look cute so that humans want to look after them. After all, most dogs are no longer wild animals. We have kept them as pets and working dogs for hundreds of years.


If humans typically pick the cutest puppies to care for, and those cute puppies grow up to have cute puppies of their own, then over hundreds of years puppies would have become cuter and cuter!

Of course, this can’t explain why humans find baby pandas, seahorses and tigers so loveable. What’s the cutesy baby animal you’ve ever seen?


THINK
DIGITAL ACADEMY