A Series of Impossible Questions

By Isabel Thomas

Why Are There So Many Living Things?

THINK DIGITAL ACADEMY

Scientists think that Earth is home to around 8.7 million different types of plants, animals, fungi and other living things. Throughout history, people have tried to explain how they all got here. The answer was found by looking very closely at nature and piecing together the clues.

We can find all these clues by
peering into a pond full of tadpoles.

Clue 1

There’s only a certain amount of food, water and shelter in the pond – not enough for all these tadpoles! There are also some predators that like to eat tadpoles (can you spot them?)

This means that … it's said, but not all the tadpoles will survive to become adults frogs. It's the same with the seeds on a dandelion or the acorns on an oak tree. Most living things have more offspring than can possibly survive.

When you put these facts together, they explain how creatures adapt to their habitats over time. At first, the new group of tadpoles might be that different from last year's group – just a few more tadpoles with longer tails. But imagine the same process going on for hundreds, thousands or even millions of years.

Eventually, the tadpoles in this pond may be so different from tadpoles living in other ponds that they have become an entirely different type of animal!

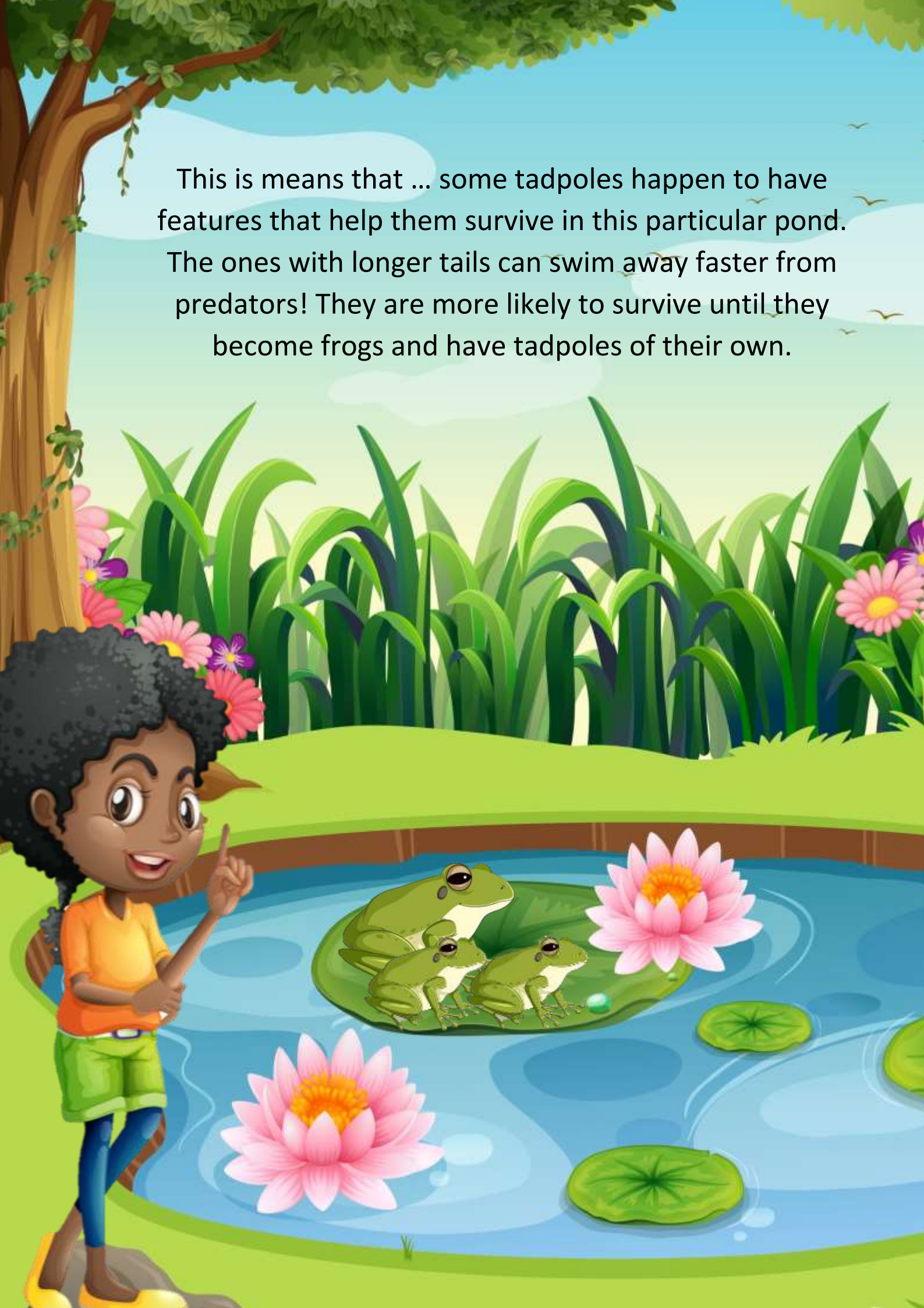

This explains HOW different types of living things come about, but why so many?

Well, the first living things appeared on Earth about 3.8 billion years ago. Since then, they have been moving around and adapting to millions of different habitats all over the world. As they became better adapted to the habitats they found themselves in, they became less and less like their ancestors.

Over billions of years, tiny changes have added up to the BIG differences we see today – the differences between a polar bear and a palm tree, between a newt and a gnat, or between a penguin and a person!

Clue 2

The tadpoles aren’t exactly the same as each other. There are lots of small differences, such as the length of their tails. We call these differences, variation.


This is means that … some tadpoles happen to have features that help them survive in this particular pond. The ones with longer tails can swim away faster from predators! They are more likely to survive until they become frogs and have tadpoles of their own.

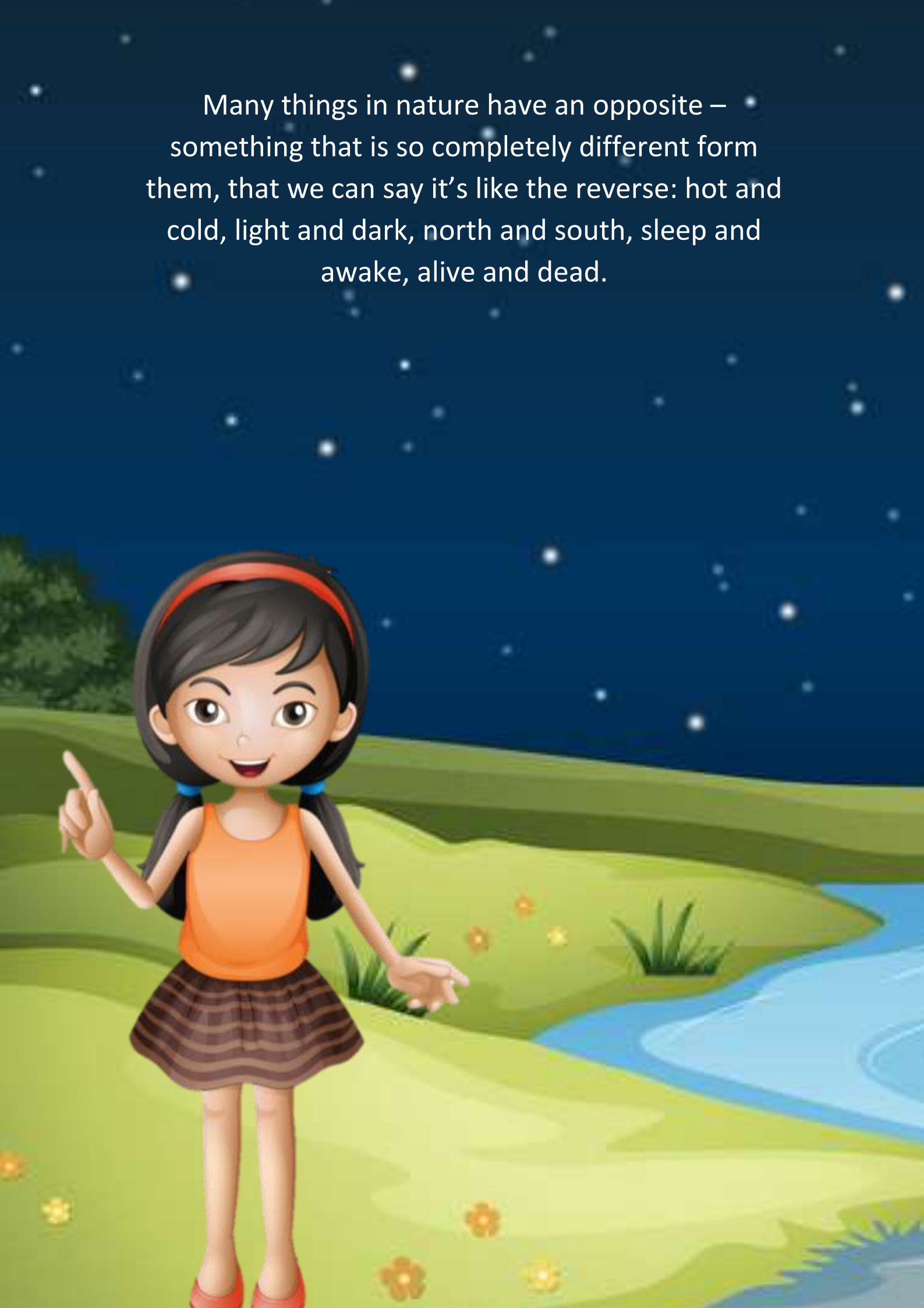
Clue 3

Parents pass many of their features on to their offspring – for example, the length of their tails.


This means that … the tadpoles that survive long enough to become frogs and have tadpoles of their own, will pass on their features – including the ones that helped them survive.


What's the Opposite of a Spider?

Many things in nature have an opposite – something that is so completely different form them, that we can say it's like the reverse: hot and cold, light and dark, north and south, sleep and awake, alive and dead.



Can we use these natural opposites to answer this impossible question?


A spider has eight legs, so perhaps its opposite is an animal with eight arms.


A spider walks on land, so perhaps its opposite is an animal that swims in water.


A spider has a tough outer skeleton, so perhaps its opposite is an animal with no

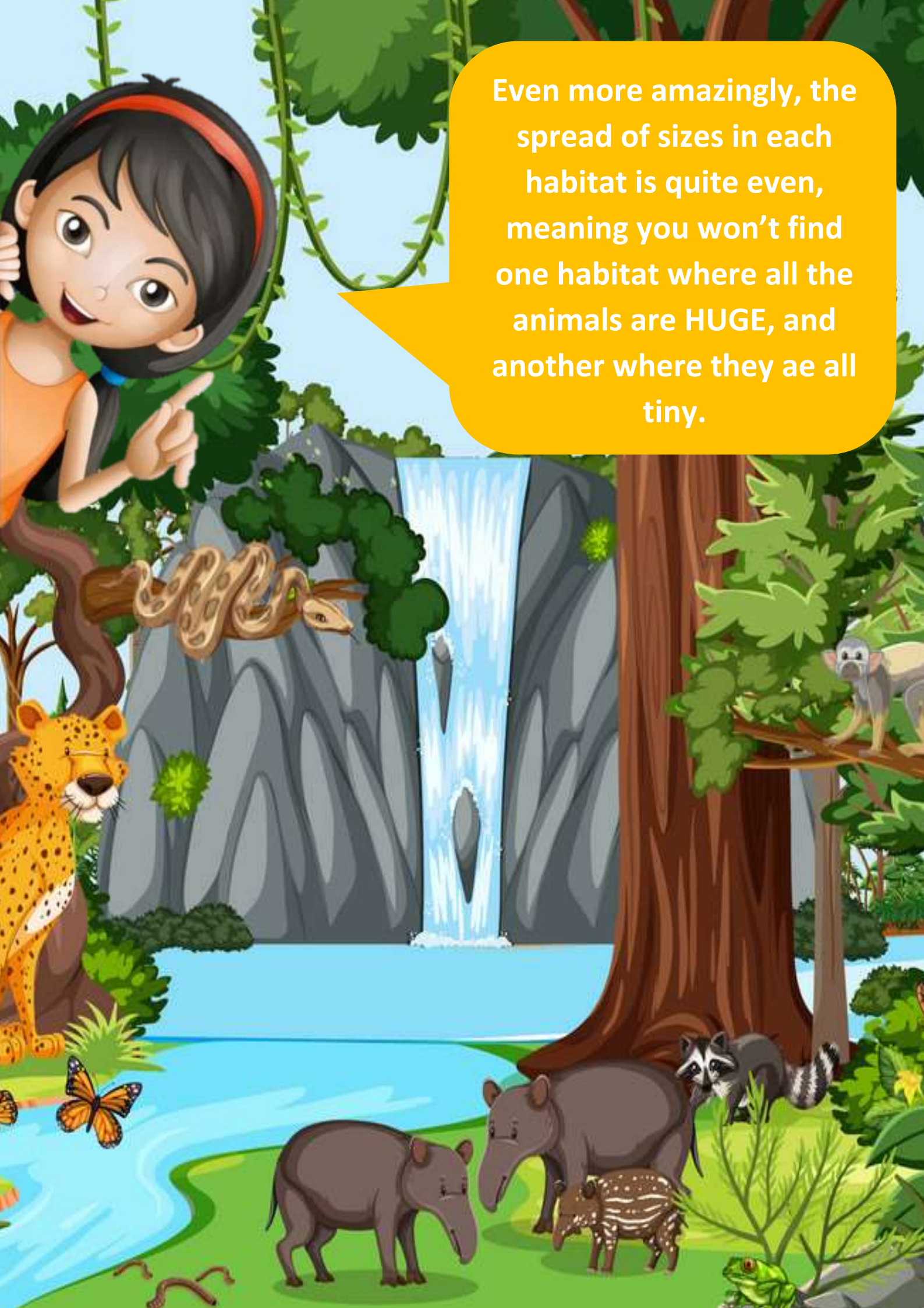
Can you think of any creatures that might fit the bill?

Can you ask another ‘impossible opposite’ question?
Use real opposites to come up with an answer.


Why are Animals Such Different Sizes?

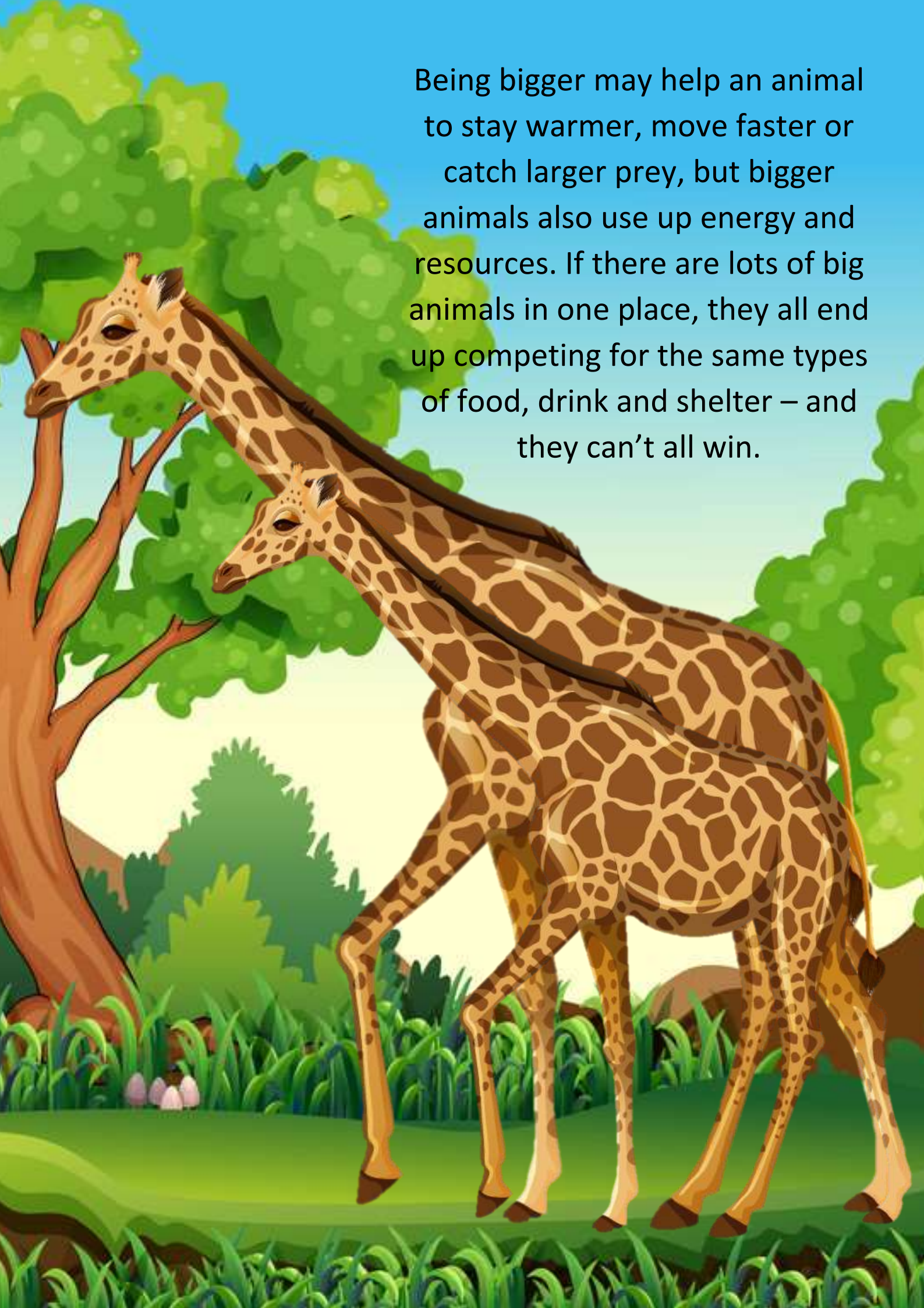

If you lined up the animals that live in any habitat – from a vast forecast to a deep ocean – you'd find a huge range of sizes.


The largest whales weigh around 2 trillion times more than the smallest water mites.

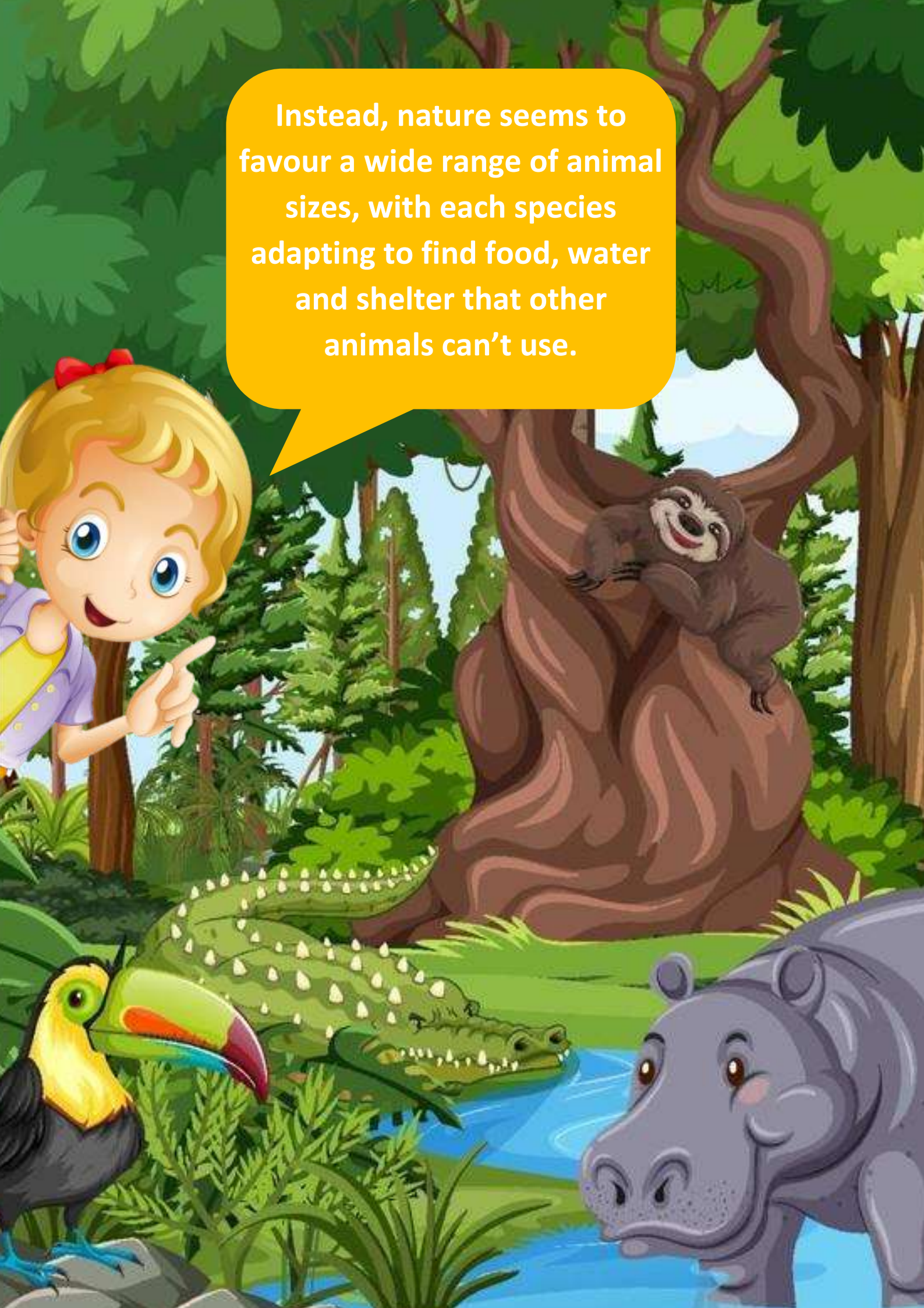

Even more amazingly, the spread of sizes in each habitat is quite even, meaning you won’t find one habitat where all the animals are HUGE, and another where they ae all tiny.

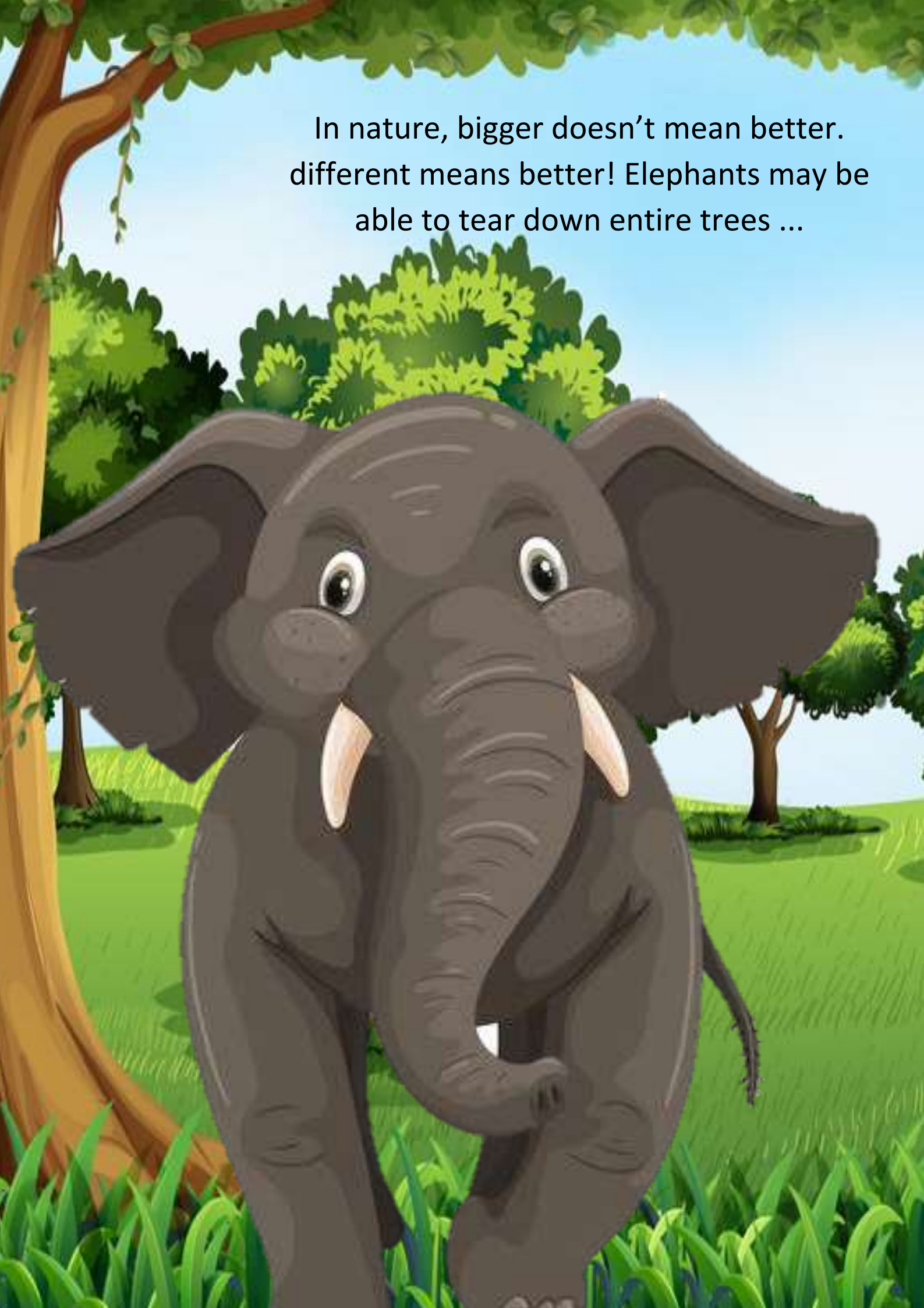
So why are the oceans home to creatures as large as blue whales, and as small as krill? And why do some mammals grow to the size of a truck, while others could perch on your little finger?

Each part of the world – even your garden – is packed with habitats of different sizes. A whole forest can be a habitat – but so can a single leaf, or the space under a stone.



Being bigger may help an animal to stay warmer, move faster or catch larger prey, but bigger animals also use up energy and resources. If there are lots of big animals in one place, they all end up competing for the same types of food, drink and shelter – and they can’t all win.


Instead, nature seems to favour a wide range of animal sizes, with each species adapting to find food, water and shelter that other animals can’t use.


In nature, bigger doesn’t mean better.
different means better! Elephants may be
able to tear down entire trees ...

... but they can’t sip nectar from flowers like a hummingbird can.


And lions might
be great at
catching zebra ...

... but they'll never beat ants at creeping into a picnic and making off with the best snacks.

If Everything is Made of Atoms, are Feelings Made of Atoms?

Feelings happen in our brains, and like everything else in the universe, our brains are made of atoms.

However, when we feel a feeling, our brains aren't simply firing up certain areas that mean 'fear' or 'joy' or 'excitement'. Like most impossible answers, it's not as simple as that!

Like most impossible answers, it’s not as simple as that! Scientists believe that every feeling has THREE parts.

#2 Your brain searches old memories and thoughts, trying to make sense of these changes.

#3 Your brain produces a feeling that makes you want to behave in a certain way.

#1 Your brain notices changes in your body.

Imagine that you're standing at the top of a steep skate ramp. Before you've had a chance to think anything, you heart begins to beat faster. Your mouth feels dry. Your palms are sweaty. Your muscles tense up. signals from all these parts of your body reach your brain.


To work out what on earth is going on, your brain scans your memories for helpful clues. It uses this information to quickly produce a feeling that makes you want to behave in a certain way.


If you have memories of successfully skating down a ramp, your brain might take note of your faster heart rate, dry mouth and sweaty palms, and produce a feeling of **EXCITEMENT.**


But if you are standing at the top of that ramp for the first time (or you remember falling off in the past), your brain might interpret those same body signals in a different way – producing a feeling of **FEAR** instead!

Feelings are reactions that happen in your brain, which is made from atoms but when your brain builds a feeling, its drawing on your experiences and your imagination.


So, we will never be able to take a bunch of atoms and use them to build a feeling. Every feeling is unique to the person feeling it.

Do Plants Have Feelings?

Have you ever seen a happy houseplant, a terrified tree or a cross cactus? It’s impossible to know for sure, because we can’t ask a plant how it’s feeling, but we can do some detective work, by designing experiments that give us clues.

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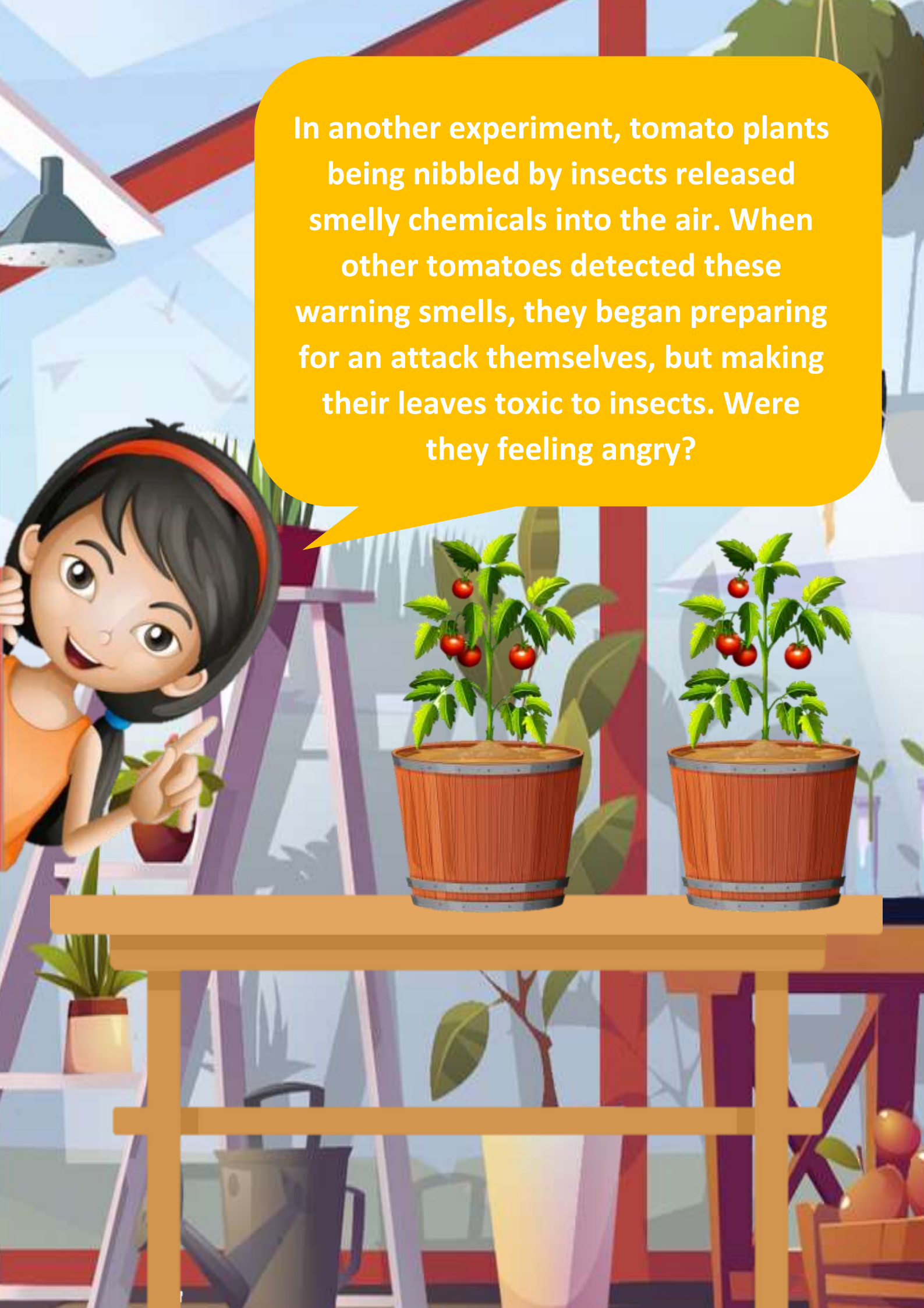
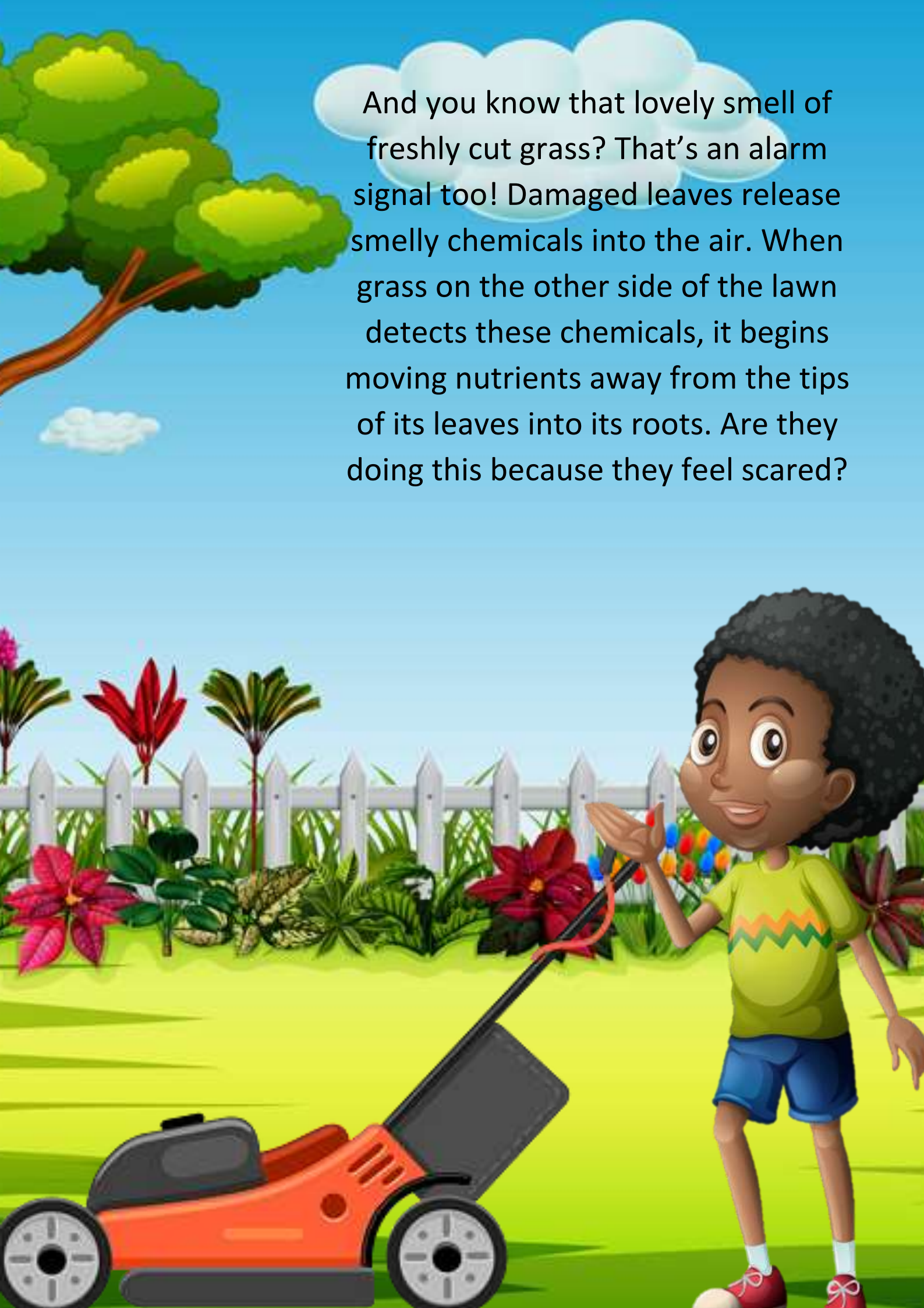
Are they just feelings in a different way?


To find out, one team of scientists grew a group of thale-cress plants and played them a SCARY sound – the crunching noise of caterpillars chewing leaves. The plants responded as if they were really being attacked, flooding their leaves with chemicals that insects find disgusting.


In another experiment, tomato plants being nibbled by insects released smelly chemicals into the air. When other tomatoes detected these warning smells, they began preparing for an attack themselves, but making their leaves toxic to insects. Were they feeling angry?


And you know that lovely smell of freshly cut grass? That’s an alarm signal too! Damaged leaves release smelly chemicals into the air. When grass on the other side of the lawn detects these chemicals, it begins moving nutrients away from the tips of its leaves into its roots. Are they doing this because they feel scared?

Probably not. Although plants CAN sense changes and respond to them, experiments like these have found no evidence that plants ‘feel’ angry or afraid before they react.

Feelings help animals to react quickly, by comparing what is happening around them with past experiences. Plants don’t seem to build these inner worlds. They just respond automatically.

So you can climb that tree roll on the grass, pick that apple or make a daisy chain without worrying – the plants (probably) don't mind at all.

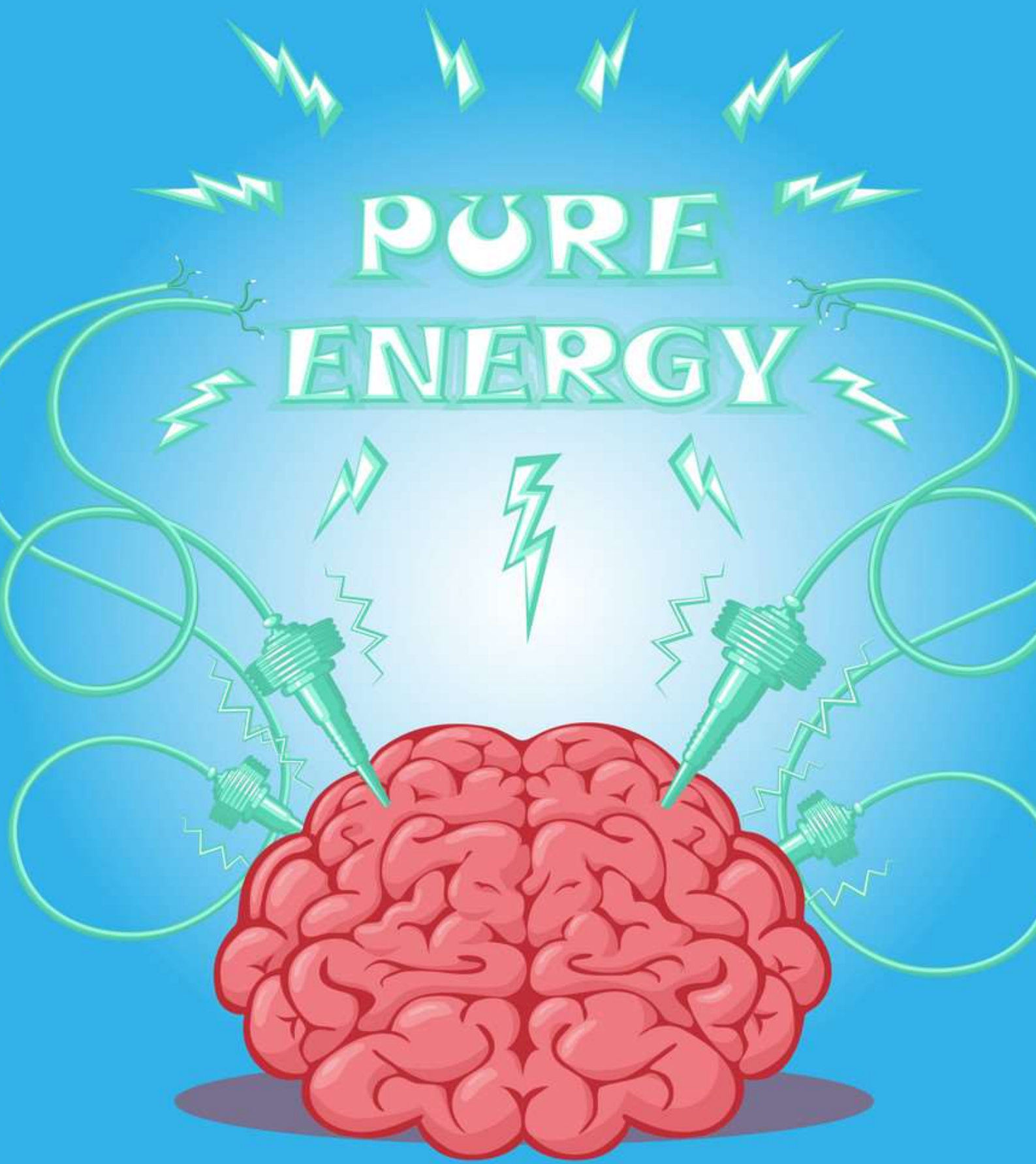
Where Do New Ideas Come From?

Sometimes, you're strolling long or staring out of the window, when your brain lights up with a BRILLIANT idea! Where do these brainwaves come from?


If you knew, perhaps you could
pluck new ideas from your head
when you REALLY need them –
like on a rainy day at school,
when your mind feels as blanks
as the page in front of you.

The bad news is, there IS NO MAP to help you find new ideas. The good news is, you don’t need one!

New ideas aren’t really that ‘new’ at all. your brain is just selecting some of the things you’ve already learned, seen, thought and experiences, and combining them in a new way.



Even Isaac Newton (whose new ideas included gravity) pointed out that he was using the ideas and discoveries of the past. He described this is as ‘standing on the shoulders of giants’.

So where do we find some giants to stand on? Reading, learning, experimenting and playing are all ways to stuff your brain with raw material, which your imagination can connect in new ways.

The second trick is avoid trying too hard to make these connections. Many people find that when they are TRYING to be creative, their minds go blank. Research has found that new ideas often come when we are doing something – or nothing – that lets our minds wander freely!

With time and space, your brain might just decide to try out new, unexpected pathway between two things that weren't previously connected. These leaps of imagination are the source of new ideas, and they're impossible to predict.

Try a version of this famous experiment yourself. Choose a random object from your house, such as a clothes hanger or a fork. Give yourself two minutes to list as many uses for it as you can think of.

Then take a break. Do something relaxing that lets your mind wander, such as walking outside or staring out of a window. Try the task again and see if your relaxed brain has come up with new ideas!

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