SCIENCE FOR Little Hearts AND Hands

THE BIG BOOK of SCIENCE STORIES

FIELDS and FLOWERS

The Good and the Beautiful CURRICULUM

Created by The Good and the Beautiful Team
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LUCIA'S CHRISTMAS FIR

Illustrated by Shannon Vogus

Lucia stops and sniffs the crisp, cold air. The smell of pine trees is everywhere, and she is so excited for Christmas! Skipping along next to Mama, Lucia looks around at the snowy Christmas tree farm. This year she gets to choose the biggest, most beautiful tree for her family's living room, and when they get home, her family will add decorations and lights to the tree! She stands by the sign that says "Fraser's Fir Farm" and smiles while Mama takes a picture.

The California redwood trees, which grow along the western coast of the United States, can reach heights of more than 91 meters (300 feet). That's as tall as eight or ten houses stacked on top of each other!

Too excited to go slowly, Lucia runs ahead to Papa, who is carrying his big red saw and making footprints in the snow with his heavy winter boots. They walk through rows and rows of dark-green trees that are wider at the bottom and shaped like a triangle. Lucia notices that these trees still look just as awake and alive as they did in the summer. The trees in her yard at home have lost their leaves and look like they're asleep.

"Papa, why are these trees still green?" Lucia asks, gently touching a tree.

Papa smiles down at his curious girl. “The trees at home aren’t able to handle cold weather. They pull all the food that was feeding their leaves into their trunks one last time, stop making food, and close off the connection to their leaves. The leaves die and fall off. Then the trees at home sleep through the winter and grow new leaves in the spring.”

Conifer needles have a waxy coating called cutin [KEW-tin], which traps water in the needle, keeping the tree alive and green through the winter. The water is stored in the needle during the winter and used to make food during the spring and summer.

Papa goes on, pointing to the tallest tree in the row. “These trees are called conifer [KAH–nuh–fer] trees. Sometimes they’re also called evergreen trees because their needles stay green all winter.”

He holds up something thin and green. “Most conifer trees have needle-shaped leaves. These needles are thicker and sturdier than other leaves, so they can survive cold weather. The needles store the sugar the tree makes in the summer, and that’s why they won’t die and fall off when it starts to get cold outside. In fact, some needles can stay on a tree for as long as ten years!”

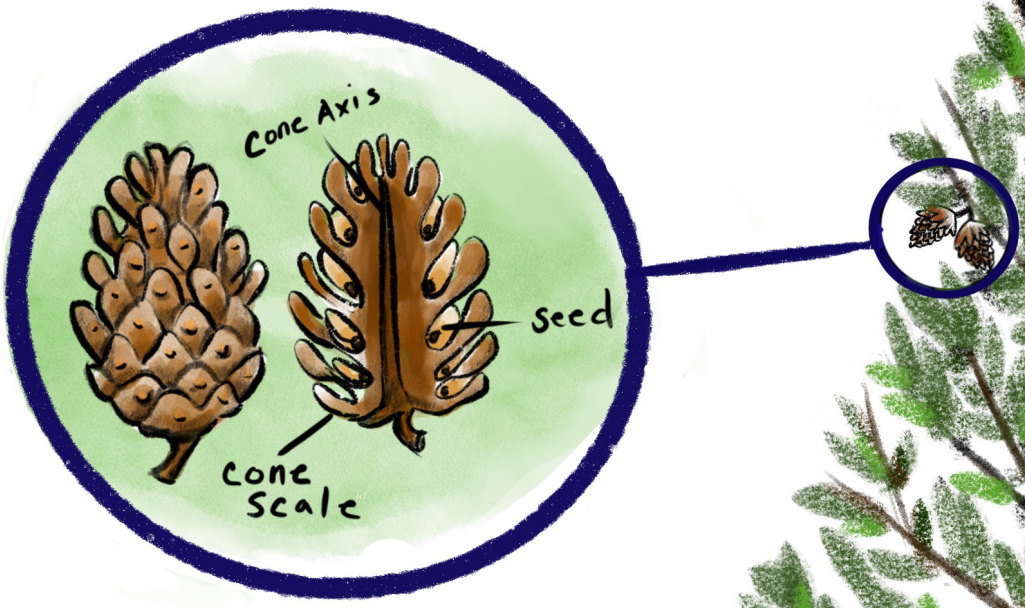
Here is an interesting fact: the seeds of some conifer trees are edible. Toasted pine nuts make a tasty pesto sauce when blended with basil, garlic, and olive oil!

Lucia twirls in excitement, sticking her tongue out to taste the falling snow. She trips over something brown in her path. She picks it up and notices that it is round and a little prickly! It feels like wood and looks a bit like it is covered in fish scales. Looking up and around, Lucia sees many more of these hanging from the branches of the conifer trees.

"Lucia, have you found our Christmas tree?" Papa calls over to her.

Lucia shakes her head and holds the brown object up so Papa can see it. "Not yet, Papa, but what is this?"

"These are called cones," Papa explains. "They hold the seeds that will make new conifer trees in the spring. Right now, the cones are closed up tight, keeping the seeds safe from wind, animals, and the cold. In the spring the scales open and release the seeds."



Conifers have two types of cones. Female cones hold the seeds of the tree, and male cones hold the pollen. In the spring both cones open their scales. The wind blows and carries the pollen from the male cones to the seeds in the female cones. The seeds are fertilized, which means they can grow new trees. They blow away in the wind, and if they get enough dirt, water, and sunlight, they start to grow into new trees.

Papa takes Lucia's hand, and they go around a corner to a new row of trees. Lucia gasps. She sees the perfect Christmas tree! It is not too short, and it is not too tall. It has so many branches with needles and cones that she can hang her pretty ornaments on! Papa measures the tree to make sure it isn't too tall for their house. It is 2 meters (6.5 feet) tall—just right!

Conifer trees are useful to humans. Their trunks provide lumber called softwood (even though conifer wood can actually be very hard) for building, they provide firewood, and the needles and bark have been used to make medicine.

The rings on a tree trunk can tell you a lot about each growing season. If a ring is thinner, the growing season was hot and dry. If a ring is thicker, the growing season was wet and cool.

Papa begins to cut the tree down with his saw. When the tree starts to lean a lot, Mama helps him by catching the tree and laying it down on the ground. Lucia studies the area at the bottom of the trunk where it was cut. "What are these circles, Papa?" she asks, pointing to the freshly cut tree stump.

"These circles are called growth rings. The tree grows a new ring every year," Papa says. Together, Papa and Lucia count the rings. This tree is ten years old!

Mama and Papa drag their new Christmas tree back to their car. Lucia climbs into her seat and bounces happily as Papa ties the tree tightly to the roof. Lucia closes her eyes and imagines the shimmering evergreen softly glowing with her family gathered around. This is going to be the best Christmas ever!


GRAND FIR
YEW
DOUGLAS FIR
NOBLE FIR
SCOTS PINE
SITKA SPRUCE
CONIFER TREES


THE STORY
OF TWO
SPORES
Illustrated by Shannon Vogus

Deep in an emerald-green forest, there is a mushroom spore. Just yesterday, this spore was flung out into the world from the gills of its parent mushroom and carried along on the wind. It landed on a lovely, damp log. There it sits, waiting to see what will happen next.

What is it?

FUNGUS

(one fungus/many fungi)

A fungus is a member of a group of living things that look like plants but don't make food for themselves the same way plants do.

MUSHROOMS ARE A TYPE OF FUNGUS.

What is it?

SPORE

(one spore/many spores)

A spore is a tiny part of a mushroom or moss that blows away on the wind or is carried away by water or animals. It grows into a fungus or moss in another place.

MUSHROOMS AND MOSSES START AS SPORES.

On the other side of the forest, another kind of spore was released into the air by its parent moss plant. This little moss spore rode on an air current and was dropped onto the same log, right next to the mushroom spore! There it sits, waiting to see what will happen next.

Both spores have lots of growing to do. The mushroom spore needs to figure out a way to eat. It reaches its little white strands down into the log. Maybe there is some food there! The white strands join with other white strands and reach with their tips through the dead wood and the ground around it.

They begin to break down and eat the wood, leaves, and plants they find. After a while these white strands have grown to 0.8 kilometers (0.5 miles)!

The largest fungus and mushroom system known to man is thousands of years old. It is an underground network of white strands called a mycelium in Oregon, US. The fungus covers 9.6 square kilometers (3.7 square miles) and produces a type of mushroom called a honey mushroom.

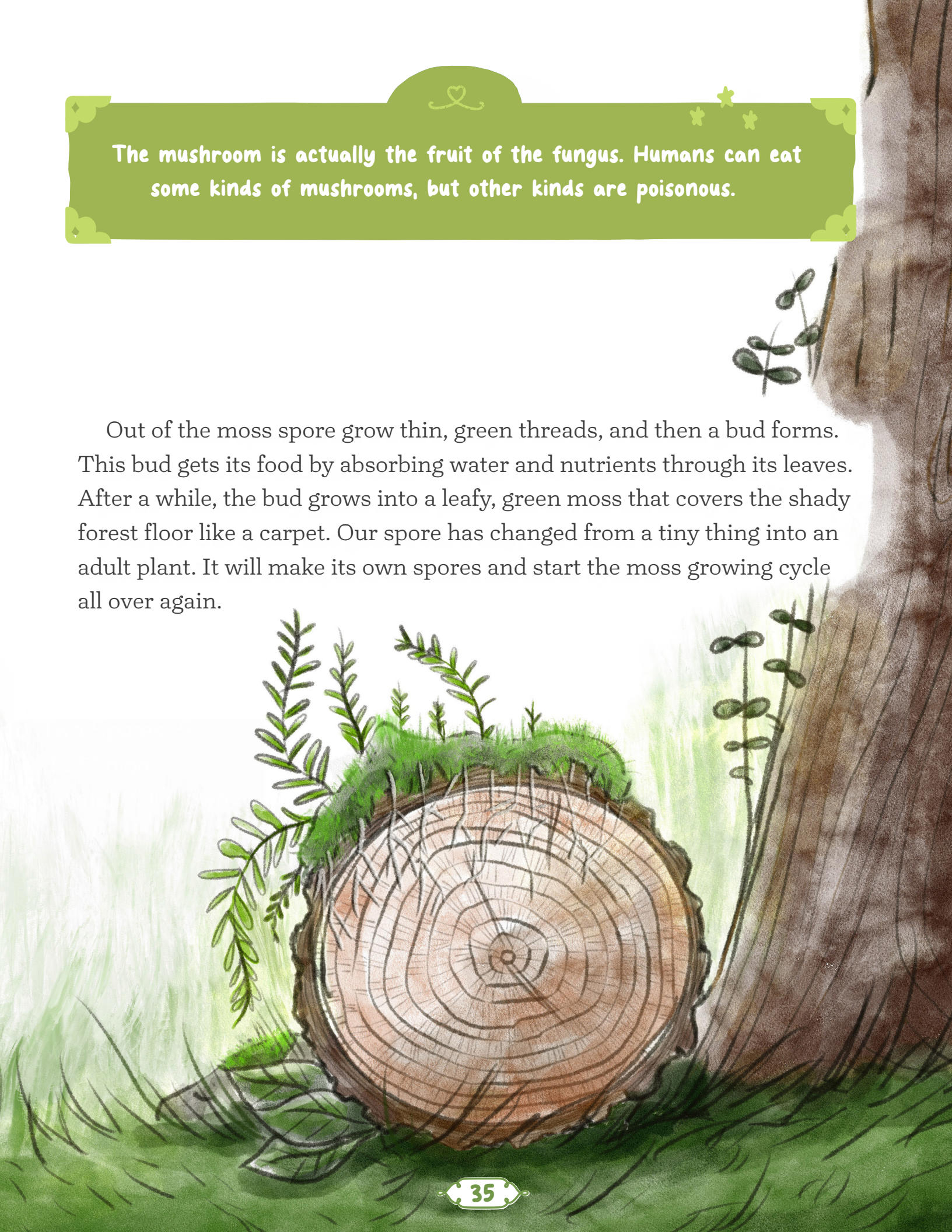
Mosses are plants that are found on every continent and in almost every climate. Moss plants can survive through the most extreme weather events and changes.

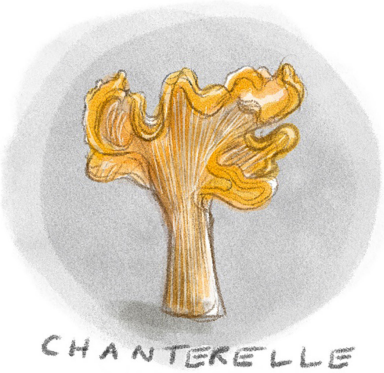
The moss spore has also started reaching out so it can grow and eat. Thin threads help the moss stay firmly on the log and help it grow, too! These threads are not quite the same things as roots, and they won't take in food for the moss, but they do act like a boat anchor. The moss is able to stay in place and grow—just not as quickly as the mushroom.

What's next for the mushroom spore? The thin white strands start to group together to form a system underground. Next, tiny baby mushrooms called pinheads begin to grow above ground. Not all the pinheads will grow into adult mushrooms. Our little spore is a strong one. It will continue to grow and will become a full-sized button mushroom. The button mushroom will soon make its own spores and start the fungus growing cycle all over again.

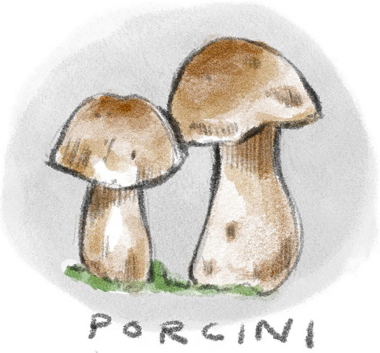
The mushroom is actually the fruit of the fungus. Humans can eat some kinds of mushrooms, but other kinds are poisonous.

Out of the moss spore grow thin, green threads, and then a bud forms. This bud gets its food by absorbing water and nutrients through its leaves. After a while, the bud grows into a leafy, green moss that covers the shady forest floor like a carpet. Our spore has changed from a tiny thing into an adult plant. It will make its own spores and start the moss growing cycle all over again.




CHANTERELLE


MORCHELLA


PORCINI

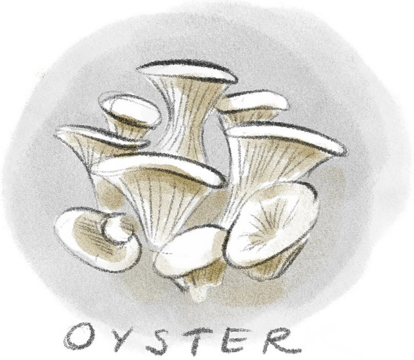

LION'S MANE

Mushrooms are so important to the living things around them. They eat dead leaves and other plant material and turn the material back into healthy soil for other plants.

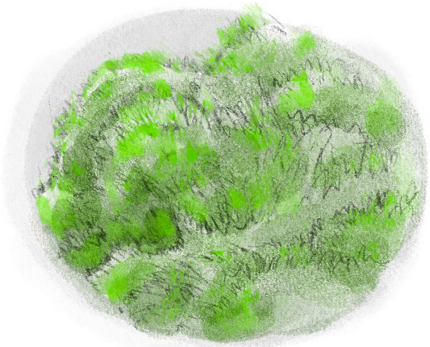

FLY AGARIC

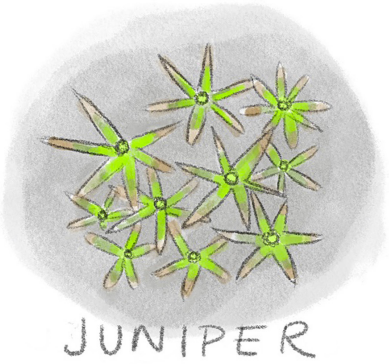

VEILED LADY


ENOKITAKE


OYSTER


HEATH STAR

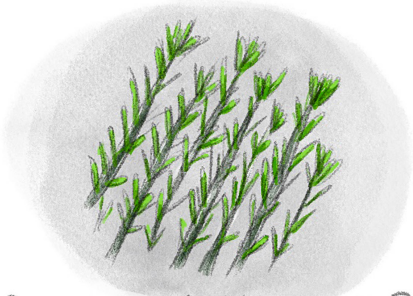

PINCUSHION

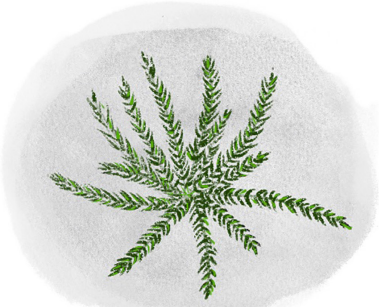

JUNIPER

Mosses are also useful to humans and the nature around them. Moss can be used for treating injuries and for farming. Mosses help by soaking up extra rainwater and keeping the soil stable.


BABY TOOTH


MOOD MOSS

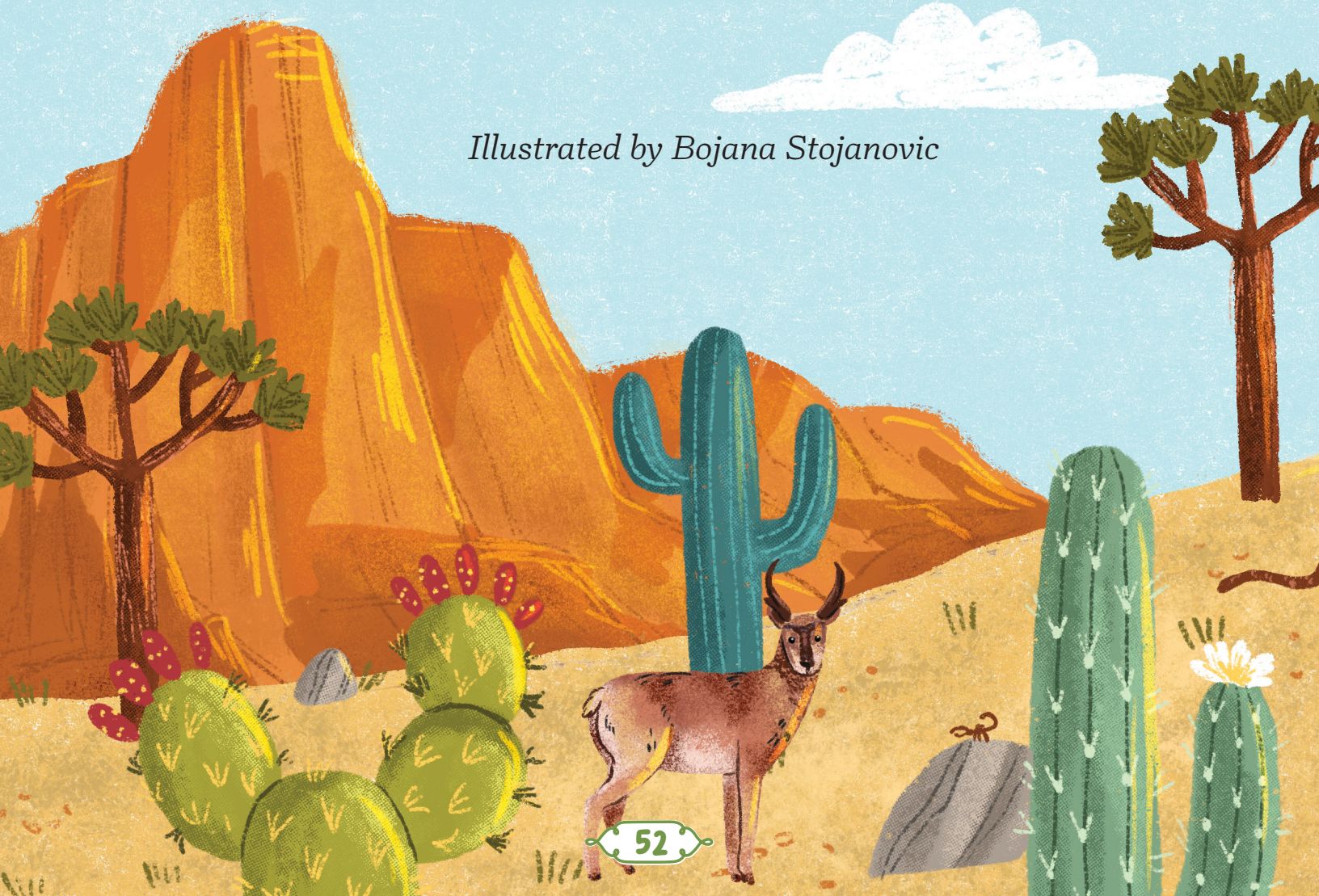

COMMON HAIRCAP


AMERICAN TREE


SPRINGY TURF

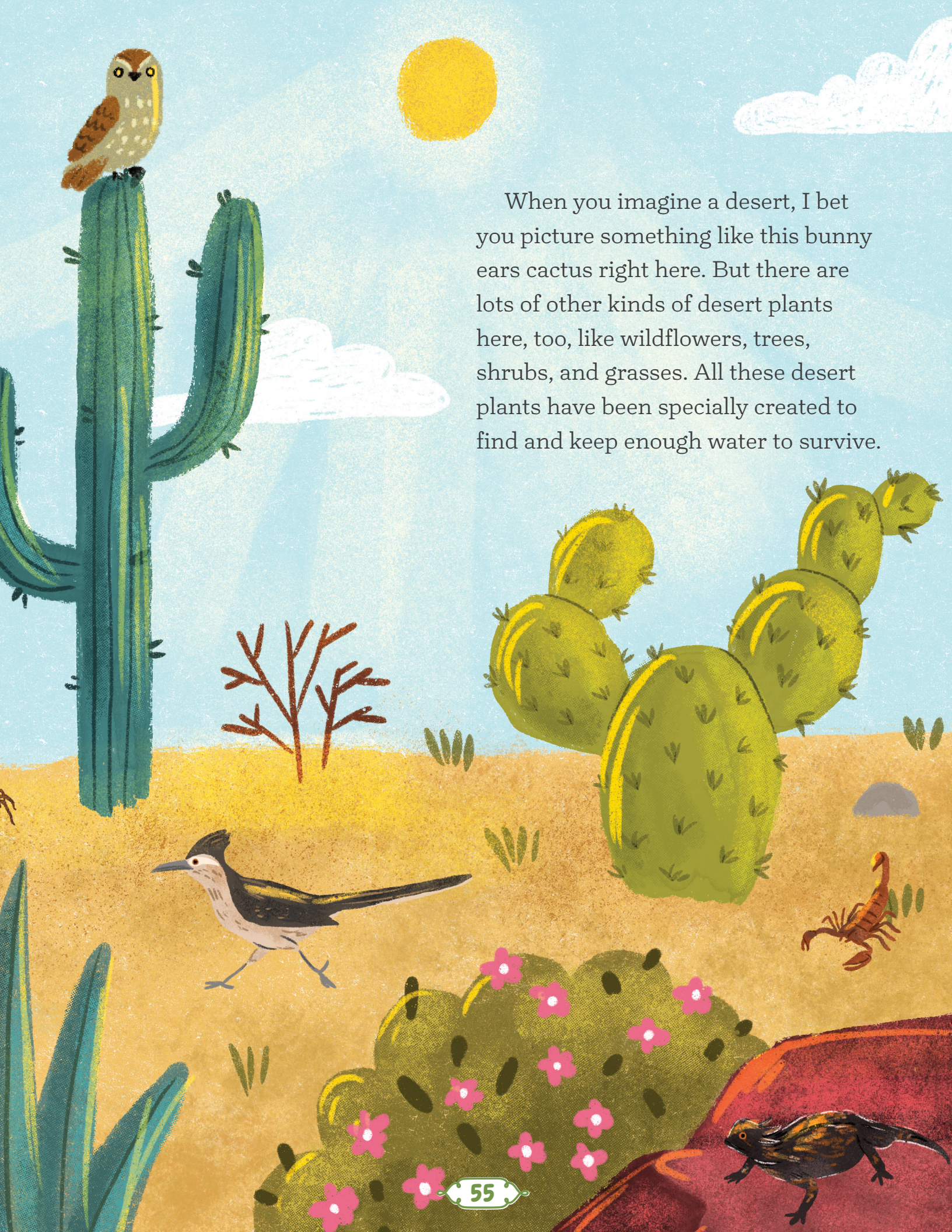
Desert Plants: Masters of Survival

Illustrated by Bojana Stojanovic



Howdy, folks! I'm Pokey Pete, the desert cowboy. I heard you're here to learn about plants that can survive in the desert. Well, you have come to the right place because those are my favorite kinds of plants. Here in the Arizona desert, we've got lots of plants to talk about!

What's a desert, you ask? It's an area of land that is sometimes covered in sand and is very, very dry. We only get about 25 centimeters (ten inches) of rain in a whole year! The days can get extremely hot, and the nights can get extremely cold. Plants that live out here are masters of survival!



When you imagine a desert, I bet you picture something like this bunny ears cactus right here. But there are lots of other kinds of desert plants here, too, like wildflowers, trees, shrubs, and grasses. All these desert plants have been specially created to find and keep enough water to survive.

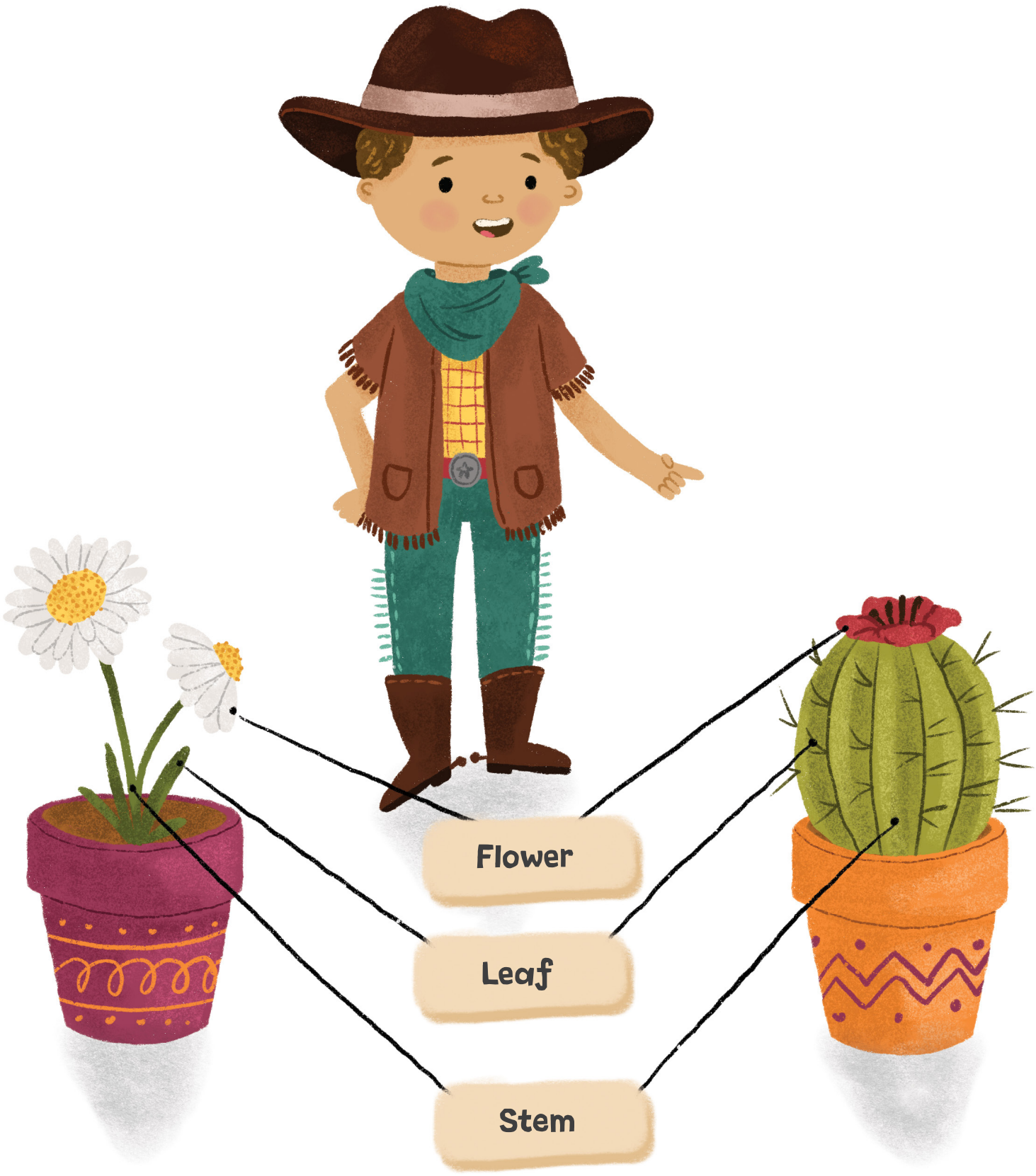
Have you ever had a big problem to solve? I sure have lots of cowboy problems. Desert plants have problems, too!

First, they have to be able to catch the tiny amount of rainfall that comes each year.

Second, desert plants need to store the water they catch so they can use it later in the dry season.

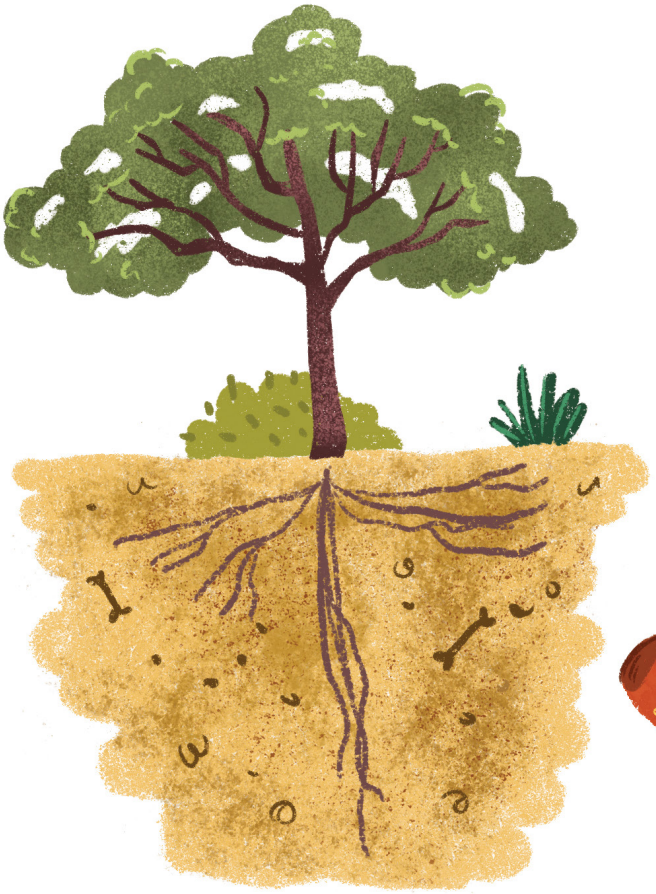
Third, desert plants need to choose the best time to make seeds and let them sprout into new plants.

Take a look at this daisy in the flowerpot. How does it look different from that barrel cactus in the ground?



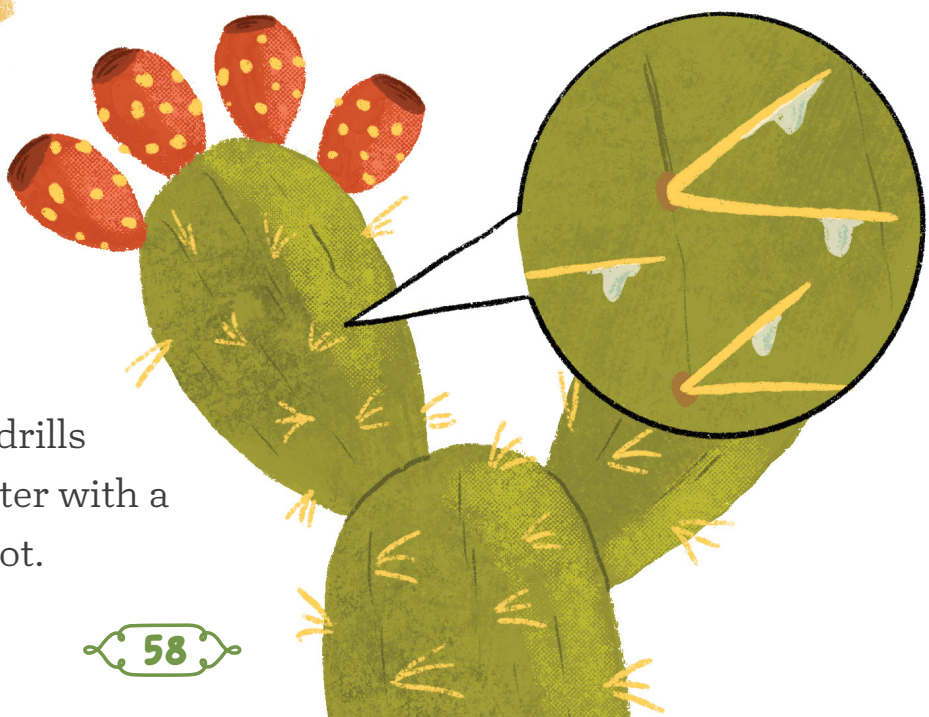
These desert plants are designed to be so resourceful! Take a stroll with me, and I'll show you all the ways they can catch every drop of rainwater that falls in the desert.

When it rains, the roots of desert plants need to catch the water quickly before it heats up and evaporates back into the air. This echeveria [eh–kuh–ver–EE–uh] plant grows roots that spread far and stay close to the surface. When the rain comes, the roots are ready and waiting!



This desert mesquite tree drills deep underground to find water with a long, thick root called a taproot.

This prickly pear cactus has spines that catch drops of rainwater or dew from fog. Then the water runs along the spines to the stem of the cactus and down the plant to the roots.



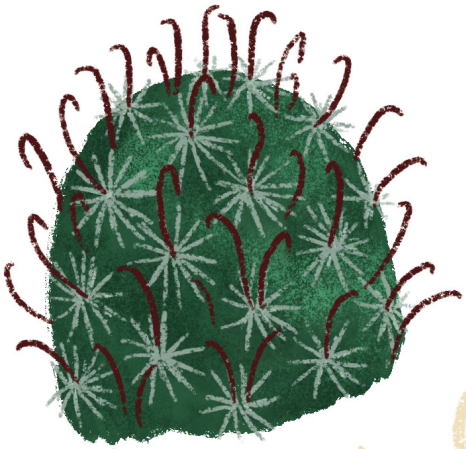
Wowee, that was quite a rainstorm! Now that the desert plants have caught some water, they need to store it. Soon it will be the dry season here, and it might not rain again for months or even years!

Can you guess where this swollen succulent is storing its water? If you guessed the part that looks like a big ol' water balloon about to pop, you're slap-bang correct! That puffy area on the golden pincushion cactus is actually its stem, and that is where it stores water.

Desert plants other than succulents can be clever, too. This desert marigold lives only when there has been enough rain and warmth. It sprouts, grows into an adult plant, spreads seeds, and dies, all within a few months. The seeds from these annual (once a year) flowers can wait years for another rainy season to come along. When it does, they will spring into life once again.

Let's mosey through this patch of colorful flowers. I betcha didn't think there would be this much color in the hot desert, did you? I'll tell you one reason they are so noticeable—bees, bats, and other pollinators! Desert plants have to grow very bright flowers so that the bees and other insects notice them and gather their pollen. Which flower is your favorite? I love the bright pink flowers on the spiny pincushion cactus!

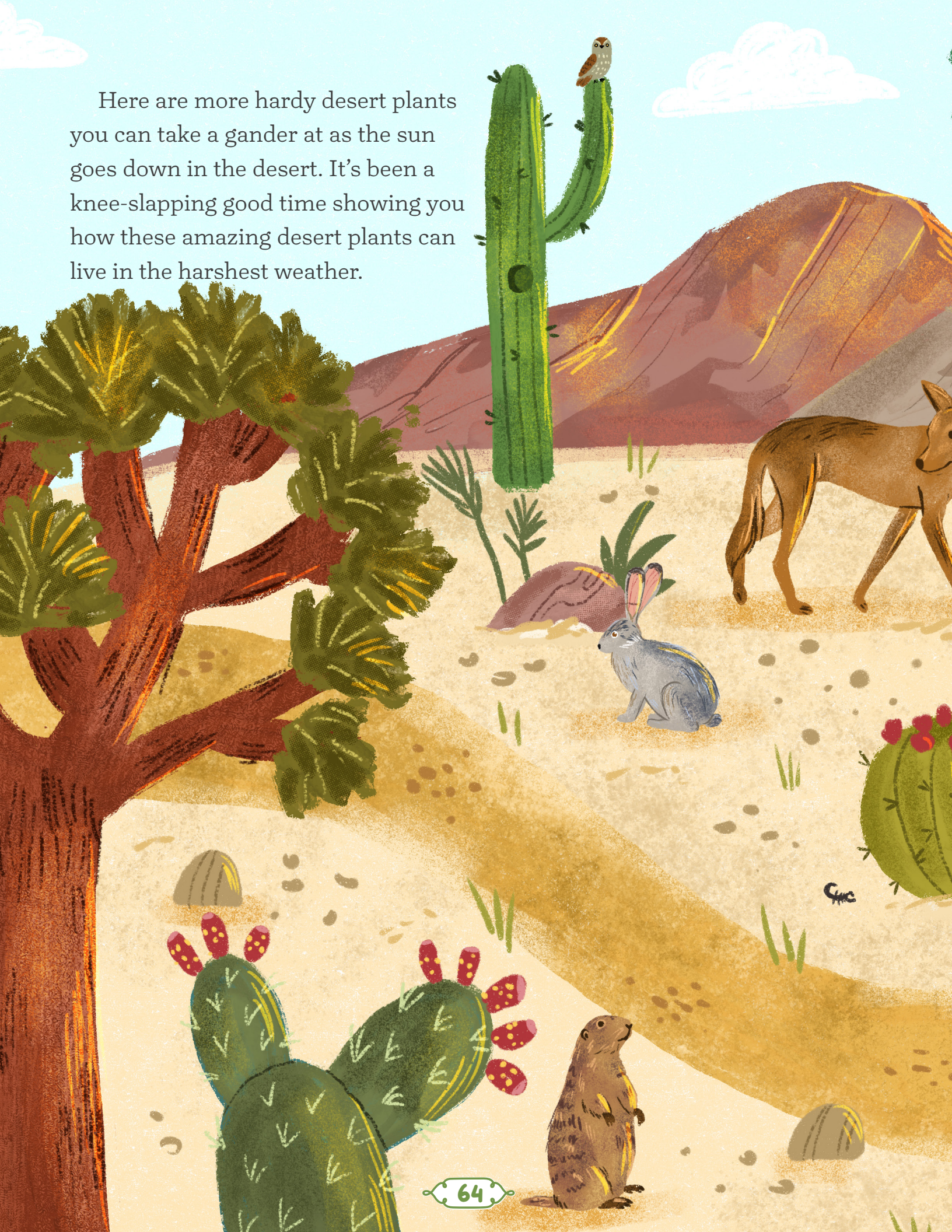
All cacti are succulents, but not all succulents are cacti. Did I make you plumb confused? I'll explain. Succulents are a big family of desert plants, and cacti are one kind of succulent. Usually cactus plants are the ones with spines. Here's a piece of good advice, straight from ol' Pokey Pete: never squish a cactus. Ouch!



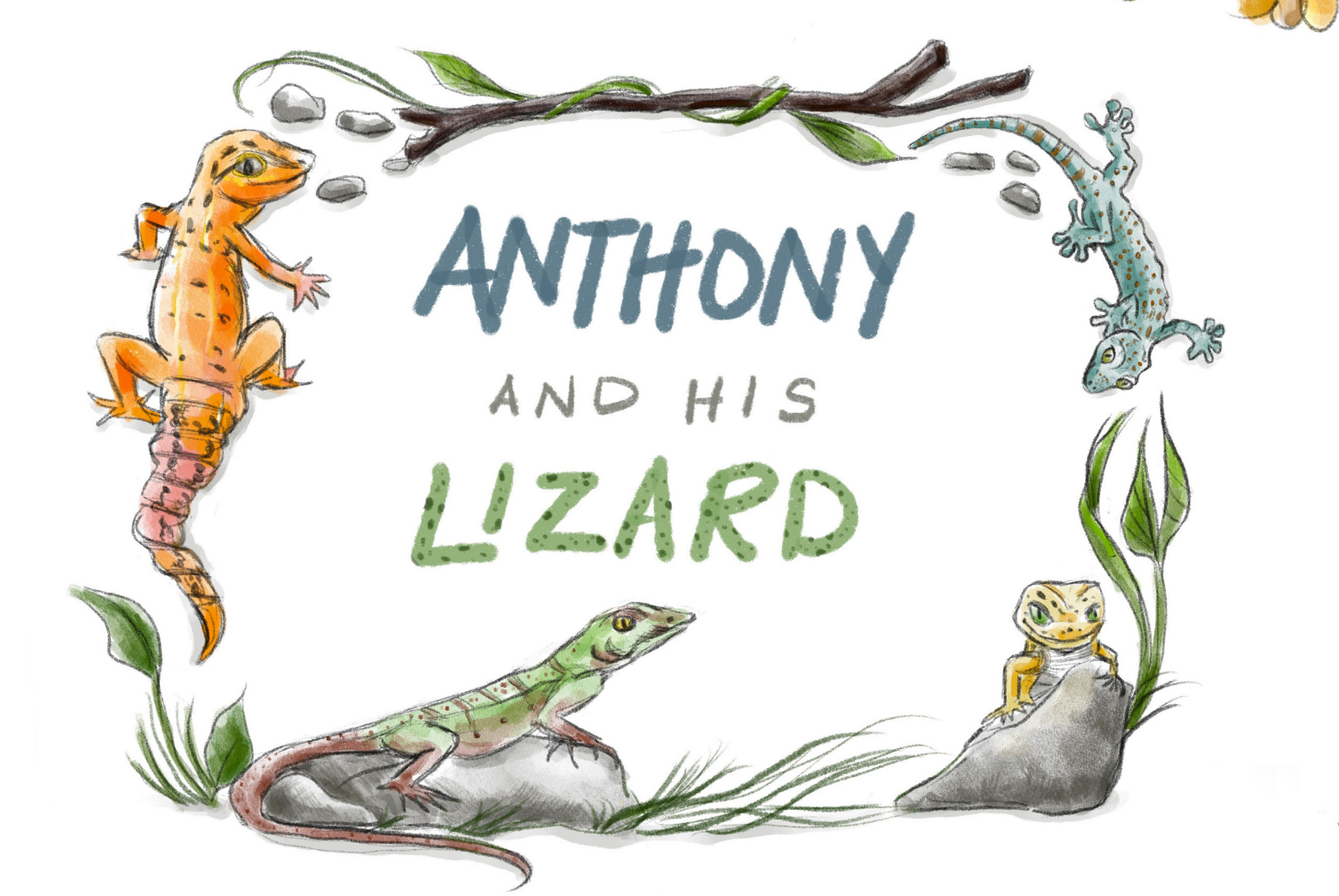
Cactus spines protect the cactus from animals trying to steal water (and people trying to sit on them), but they also help with catching water and providing shade for the plant and its roots.

Desert plants provide food and shelter for desert animals. This giant saguaro [suh–WAA–row] cactus is positively crawling with critters. It's tall enough that even I, Pokey Pete, could make a nest inside it to live in. This saguaro is about 150 years old, and some are even older!

Here are more hardy desert plants you can take a gander at as the sun goes down in the desert. It's been a knee-slapping good time showing you how these amazing desert plants can live in the harshest weather.



It's time for me to be heading on home for dinner, lickety-split. Thank you kindly for taking a few minutes to learn about the plants in my desert home. Come on back anytime!



Illustrated by Shannon Vogus

Anthony quickly shut the door of the car and jumped up and down on the sidewalk. “Let’s go, Dad! I can’t wait!” Anthony said as Dad walked towards him. “I’m excited to get a new pet!”

Anthony bounced on his toes as he pushed the door of the pet shop open and went in. He had worked so hard to save money to buy a pet of his own.

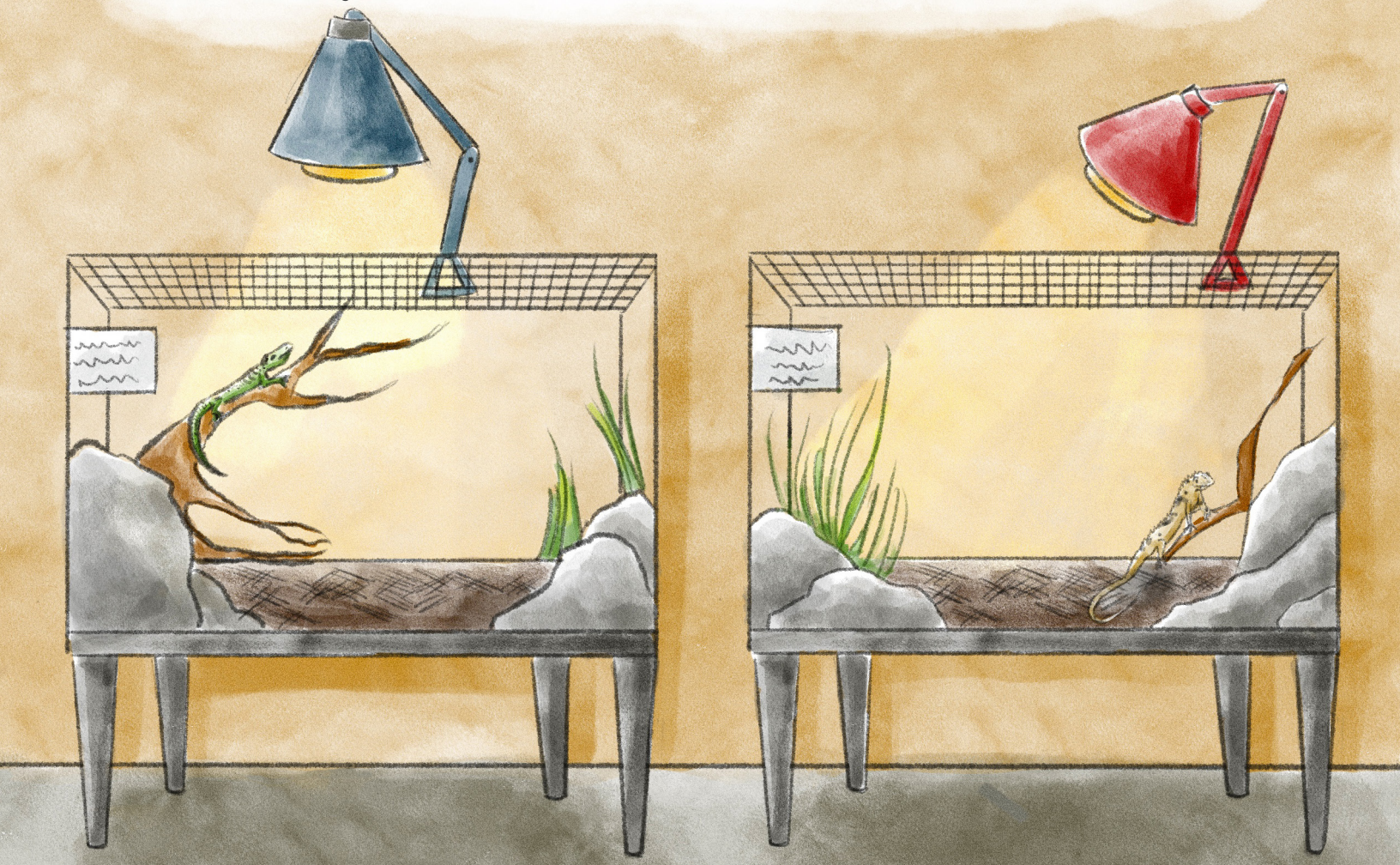
Anthony looked around with wide eyes. He saw rows and rows of tanks filled with sand, rocks, plants, and the animals Anthony was so excited about—lizards!

"Dad, did you know that lizards are reptiles? They're related to snakes, but they're not the same thing." Anthony kept talking, spouting all the facts he knew. "Lizards can't make their own body heat. It's called being ectothermic. So we're going to have to get a heat lamp for my new pet!"

"Yes, we will, son," Dad said. "Wow, look at how rough and scaly this lizard's skin is. I always thought their heads were bigger. They're pretty small, and their legs are a lot longer than I expected."

Anthony walked along the rows of tanks, looking at every detail of the lizards in each one. He stopped in front of a tank labeled "blue-tongued skink" and read from the fact sheet.

"Skinks smell with their tongues, and their ears are just holes in their heads. Wow, that's really interesting!" The skink's long, blue tongue flicked out as Anthony moved on to the next tank.

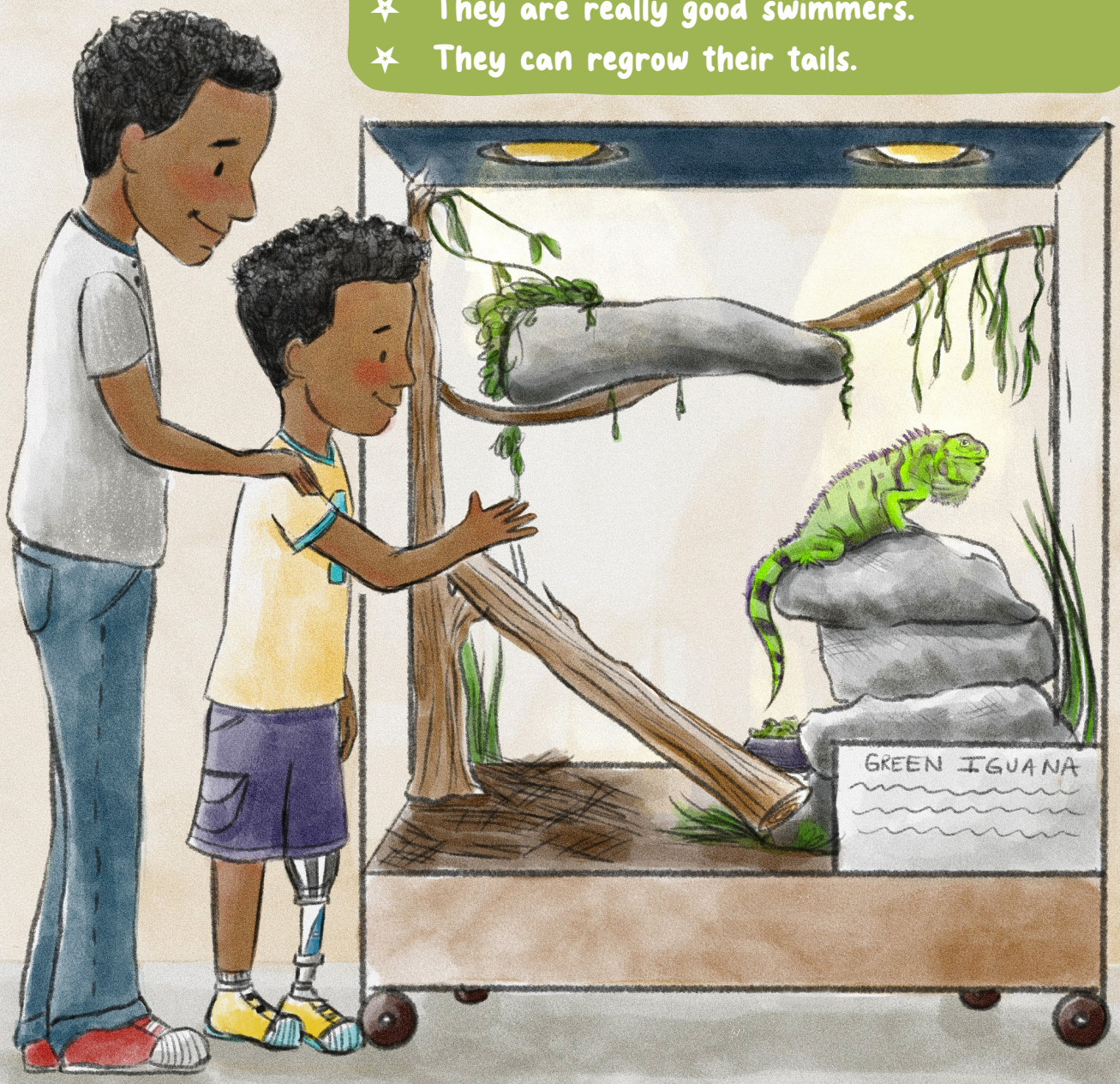


Blue-Tongued Skink Fun Facts

- They use their bright-blue tongue to warn predators to stay away.
- They can live up to 30 years.
- They do not lay eggs.

Green Iguana Fun Facts

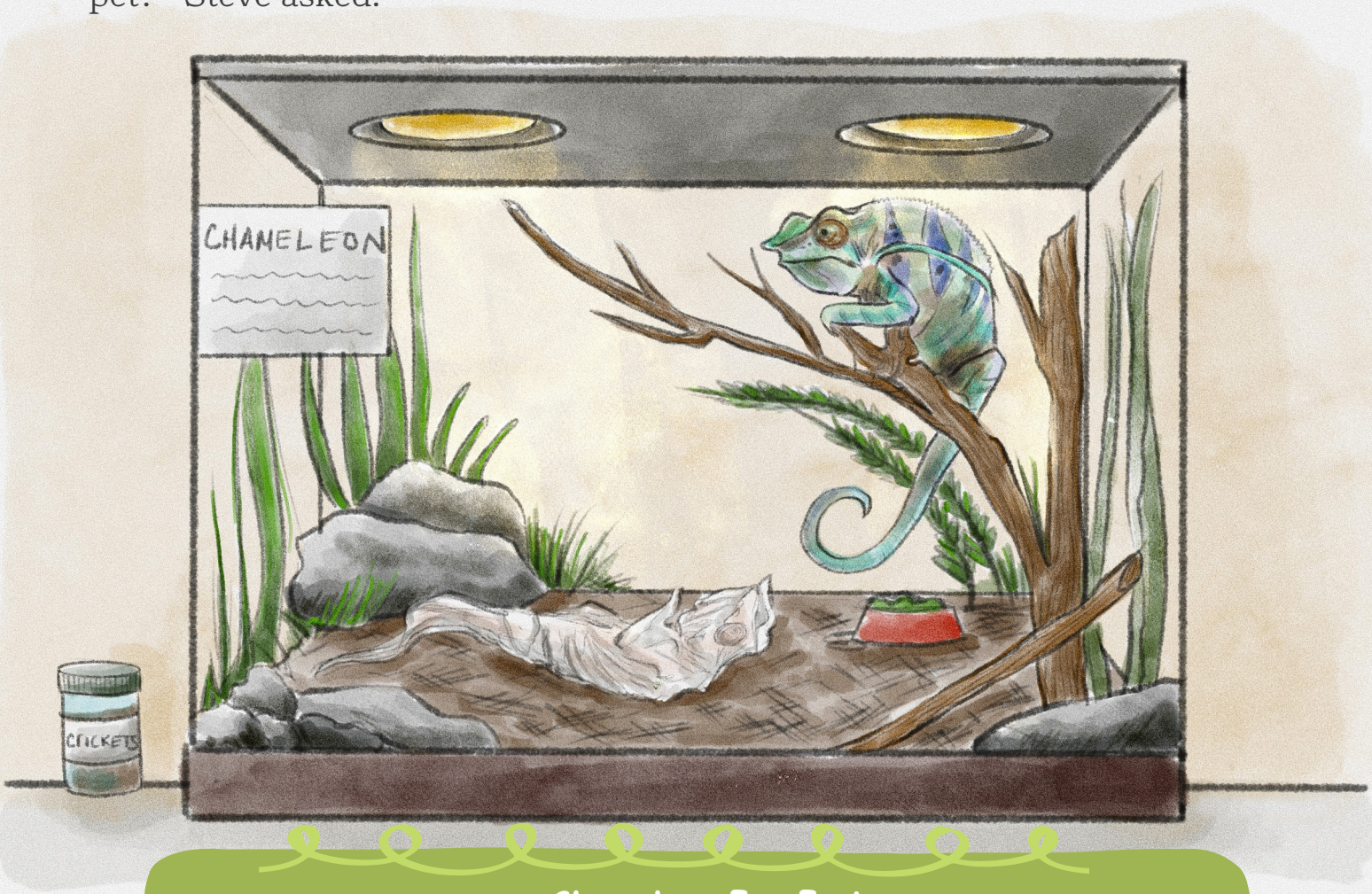
- They live in trees and can survive falls from very high.
- They are really good swimmers.
- They can regrow their tails.



"Dad, look here!" Anthony waved his dad over to a big tank with a bright-green lizard sitting on a rock. "This is an iguana. They're not actually very good pets. They can get so big, like 2 meters (6.5 feet) long, and they don't like to be held. Also, they have to live in super hot and wet tanks. I don't have iguanas on my list of pets that I want, but look how beautiful and interesting he is."

At the next tank, Anthony asked Steve, the pet shop owner, "Why does it look like there are two lizards in this tank?"

"Well, this lizard must have just molted. A lizard's skin is dry and scaly, and it doesn't grow when the lizard grows. So, lizards grow a new layer of skin under the old layer. When they're too big for the old layer, it comes off. This is called molting. Are you interested in having the chameleon for a pet?" Steve asked.



Chameleon Fun Facts

- They can change the color of their skin to blend into their environment.
- Their eyes can focus on different things at the same time.
- They do not have ear openings.

"No, thank you, sir. I have a different pet lizard in mind!" Anthony answered as he bounced to the next tank.

"Oh, wow, Dad! You have to come see this one!" Anthony was standing on his tiptoes to look down into a large tank. "This bearded dragon laid eggs."

"Neat!" Dad said. "Those eggs look like they would be soft to touch."

"They are," Anthony answered. "Lizard eggs are usually soft and leathery. Did you know that the males do all kinds of dances and show their vivid colors to get female lizards to like them?"

Dad nodded. "I think I read that somewhere. I also read that lizard babies are born knowing how to take care of themselves."

"So," Dad said to Anthony as they got to the back of the pet shop, "have you found your perfect lizard pet yet?"

"I think so. I did a lot of research on this little guy right here." Anthony pointed at the last tank in the row.

Inside was a lizard that had spots like a leopard! "It's called a leopard gecko, Dad. They normally live in the desert. They are gentle, they don't need a very big tank, and they eat crickets and mealworms. We can grow those ourselves or find them outside. I have saved enough money for him. May we buy him, Dad?" Anthony looked at his dad with big, pleading eyes.

"Absolutely. Let's talk to Steve to make sure we get everything we need for him. What are you going to name him?" Dad gave Anthony a high five as they walked to the front of the store.

"I think I will call him Spots," Anthony said, picking up a heat lamp from a shelf. "I am so excited to bring Spots home!"

"Well, you sure are going to give him the best home. I know you'll take good care of Spots," Dad said. Soon they were walking out of the pet shop with the leopard gecko in a box, ready to go to its new home.

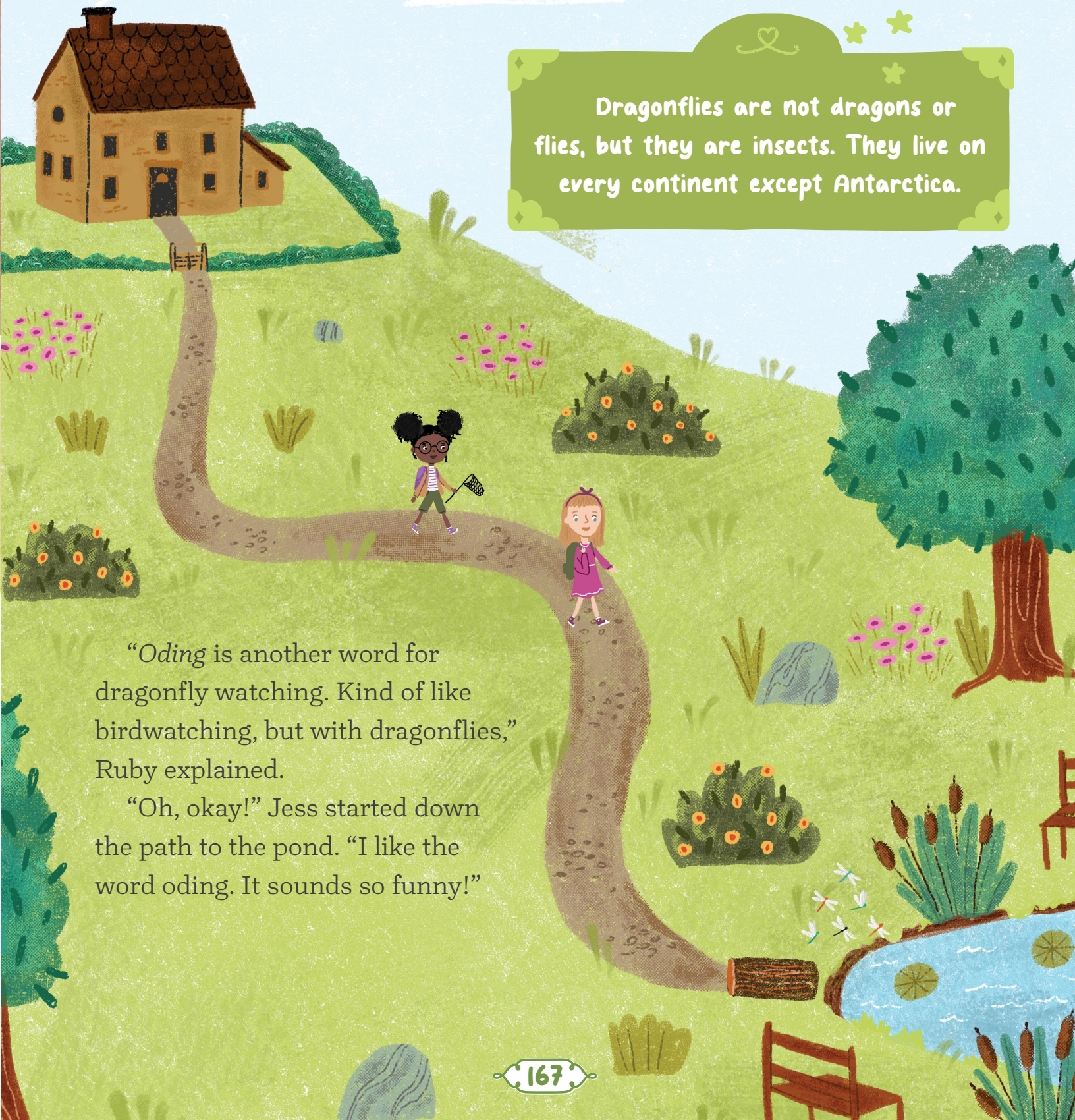
The Hunt for the Meadowhawk Dragonfly

Illustrated by Bojana Stojanovic

Ding-dong! Jess' doorbell rang. "I'm coming!" Jess called as she skidded to a stop by the front door. She opened the door quickly and found her best friend Ruby with her backpack on her shoulders and a bug-catching net in her hand.

"This is the best project we've been given at science club so far," Ruby exclaimed. "Let's go oding!"

Jess looked confused. "What's 'oding'?" she asked, grabbing her own backpack before closing the door behind them.



Dragonflies are not dragons or flies, but they are insects. They live on every continent except Antarctica.

"*Oding* is another word for dragonfly watching. Kind of like birdwatching, but with dragonflies," Ruby explained.

"Oh, okay!" Jess started down the path to the pond. "I like the word oding. It sounds so funny!"

Ruby shrugged her backpack farther onto her shoulder. “Look! There’s the pond!”

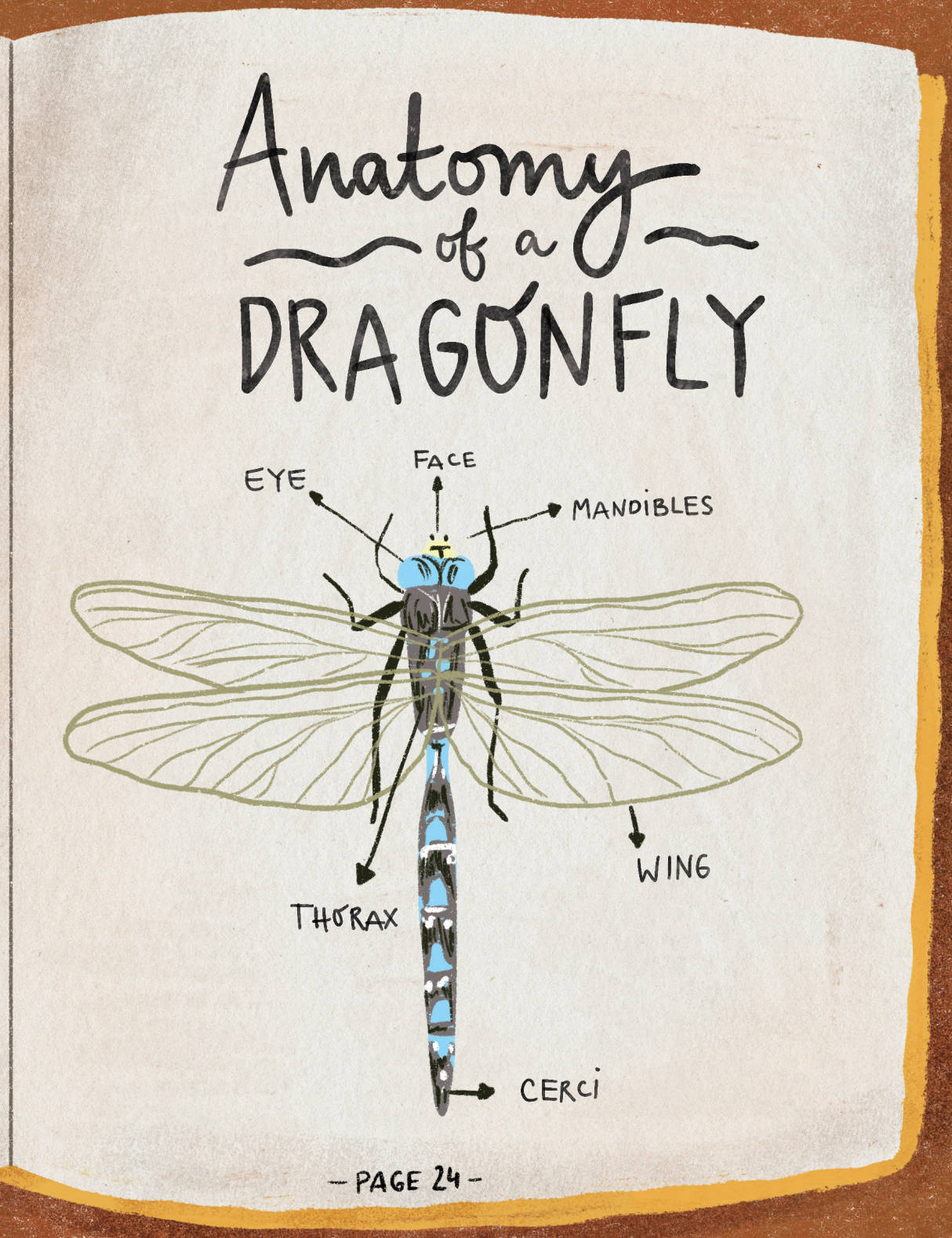
Both girls ran to a bench by the water and set down their supplies.

“Where does the book say we will find the most dragonflies?” Jess asked as she pulled their library book about dragonflies from Ruby’s backpack. “And what do they look like, exactly?”

"Dragonflies have long, thin bodies, huge eyes, and four flat, clear wings," Ruby explained. She pulled the binoculars out of the backpack. "I was thinking we could try to look for them from here first, so we don't scare them. The book says they are easiest to find at the edge of still water.

"I'm really hoping to find the Eastern meadowhawk dragonfly. I think they are the most beautiful of God's creations," Ruby whispered as she focused the binoculars on the edge of the pond.

"Me, too," Jess said quietly, flipping through the dragonfly book. "Take a look at these pictures of a dragonfly's body!"



Ruby looked over Jess' shoulder at the book. "Dragonfly wings are so amazing. I can't believe dragonflies can even fly backward!"

Jess said, "I know! And this says that they don't have to beat their wings as fast as other insects because they each have four wings instead of two. I bet they can last a long time in the air."

"Let's get closer to the pond," Jess suggested. She closed the book and put it on the bench. "Maybe we'll be able to see a dragonfly eating!" Jess turned to Ruby and tilted her head. "What do dragonflies eat, anyway?"

"They like to eat other insects like midges and mosquitoes. They're actually very helpful to humans because they keep the pest population down," Ruby answered.

Jess pointed at a spot farther down the bank of the pond. "I just saw a dragonfly hover, fly backward, and catch a mosquito in the air! I didn't know they could do that!"

Dragonflies would win the award for the fastest flying insect. They can fly at speeds of up to 56 kilometers (35 miles) per hour, and the globe skimmer dragonfly can travel across an entire ocean without stopping!

"Yes, they can," Ruby said. "Dragonflies are like acrobats in the air. They can fly upside down, turn quickly, fly backward, hover, and dart really fast. They even eat their food while flying!"

Creeping to the edge of the pond, the girls sat quietly and waited to spot a dragonfly.

"Jess! A dragonfly just landed on your head!" Ruby cried. She pulled her magnifying glass out of her pocket to take a closer look.

"What does it look like?" Jess asked, trying to stay as still as possible. "It won't bite me, will it?"

"I think it's a female green darner dragonfly. Her body is a bright-green color, and her wings are clear. Dragonflies have really strong mouthparts, but they don't usually bite people. Even if they tried, they wouldn't be able to break the skin. Look! She's headed to the water! What is she doing?" Ruby inched closer to the water as she spoke.

As the girls watched, the darner dragonfly bent the end of her tail into the water and moved it up and down.

Ruby pointed at the dragonfly. "I bet she's laying her eggs! Dragonflies start out as eggs in a pond or other water that doesn't move much. After a couple of weeks, they hatch as larvae and live in the water for a really long time."

Dragonfly larvae, or nymphs, aren't innocent little babies. They are ferocious aquatic predators, feasting on tadpoles, small fish, and other dragonfly larvae.

"I read in the book that they molt, or shed their skin, many times before they become adult dragonflies. Then they climb out of the water and wait for the sun to dry and harden their wings so they can fly away. Sometimes they are eaten by predators before they get the chance to harden their wings," Jess said, proud to tell Ruby some dragonfly facts. The girls watched the green darner fly away.

"There it is! There it is!" Ruby exclaimed as she got up from the ground and pulled Jess up, too. "The meadowhawk dragonfly! I know it's a meadowhawk because it's red like a fire truck!"

"It's just beautiful!" Jess whispered, watching the dragonfly hover for a minute, its wings making a rowing motion in the air. "I'm so glad we finally got to see one!"

Ruby picked up her camera to take a picture for their science club project. "The creatures that God created really amaze me. Let's go write our report about dragonflies and come back to see if we can find a whole swarm of them to study!"

Ruby and Jess packed up their bags and headed home, ready for a big lunch and more dragonfly studies.