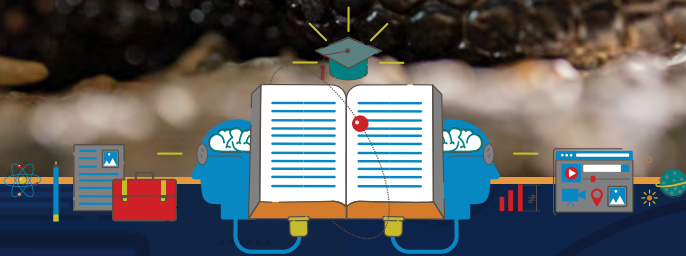
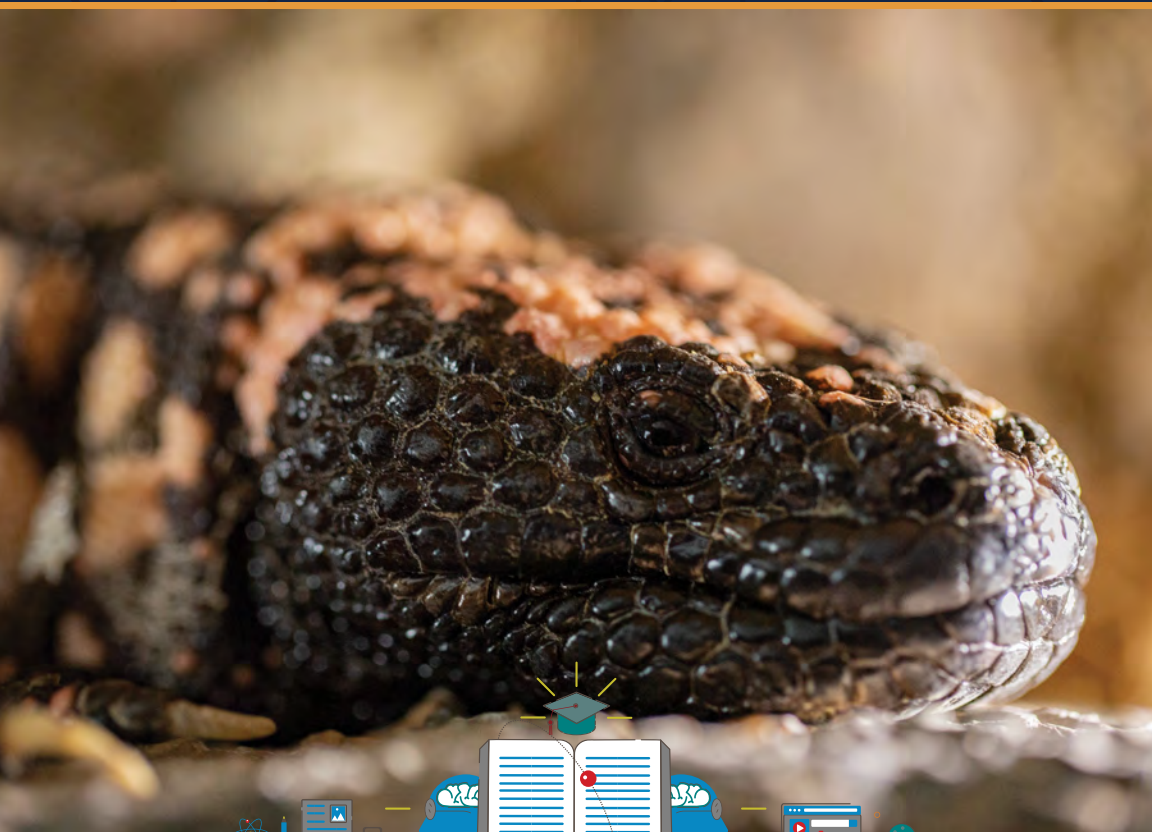


# DESERT MONSTER

A SCIENCE 3D ADVENTURE

GRADE 4



By MIKE HEITHAUS Ph.D

symbioeducation™



# KEY WORDS

Look for these words and see if you can figure out their meaning.

CLIMATE

CONDUCTOR

DEPOSITION

DESERT

ELEVATION

EROSION

HABITAT

INSULATOR

NATIVE

PREDATOR

PREY

SOLITARY

TOPOGRAPHIC MAP



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# NOT A MONSTER

What do you think of when you hear the name Gila monster? Do you imagine a dragon? Maybe you think of a huge animal that is dangerous to people? It turns out Gila monsters aren't huge at all. And even though they have venom, they are not deadly to people. Even so, they are awesome animals!

Gila monsters are lizards. Like all lizards, they are reptiles. They lay eggs with a shell and have scales to cover their skin.



Gila monsters live in **deserts** of the southwestern United States and northwestern Mexico, including the Sonoran Desert. Gila monsters can grow to about 60 centimeters (2 feet) long. They are the only venomous lizard **native** to the United States. You might think that having venom makes it easy to survive, but Gila monsters live in very harsh environments. Finding enough food, water and shelter can be a challenge. Let's explore Gila monsters and their desert home!

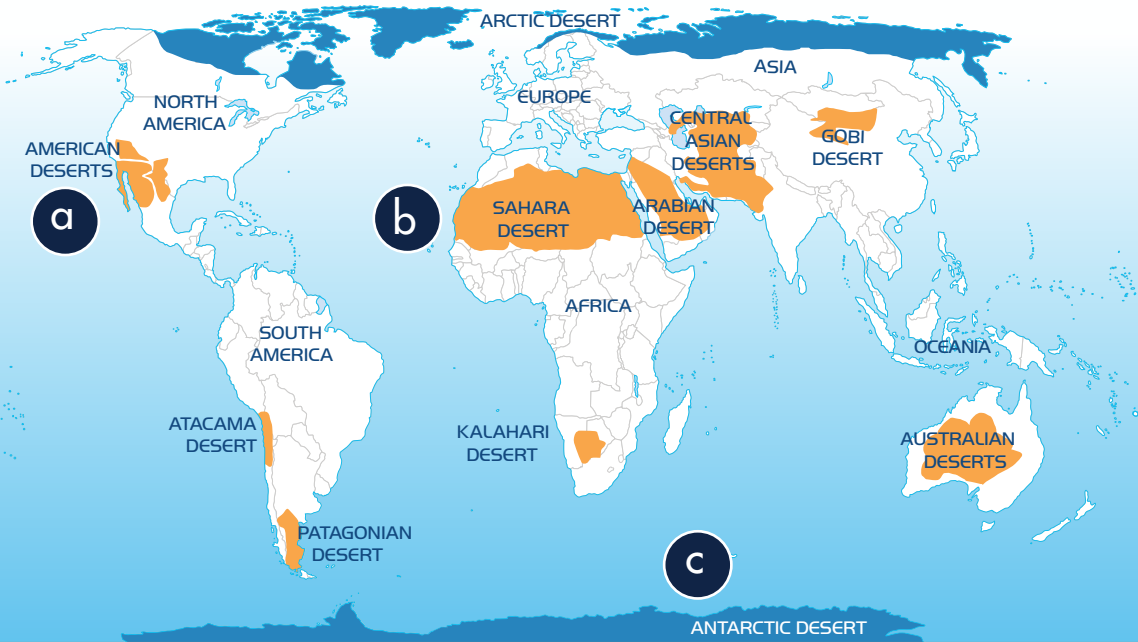


In the map above, the orange area shows where Gila monsters live.



# WHAT IS A DESERT?

Think of a desert. What kind of place do you imagine? Is it somewhere very hot and very dry? This type of desert is a subtropical, or hot and dry desert. But, subtropical deserts are not the only type of desert. All deserts have little rain. Some have almost no rain. But not all deserts are hot. Semiarid deserts have long, hot, and dry summers. In the winter, it is cool and there can be some rainfall. Coastal deserts have cool winters and warm summers. Cold deserts, like Antarctica, are cold all year long.



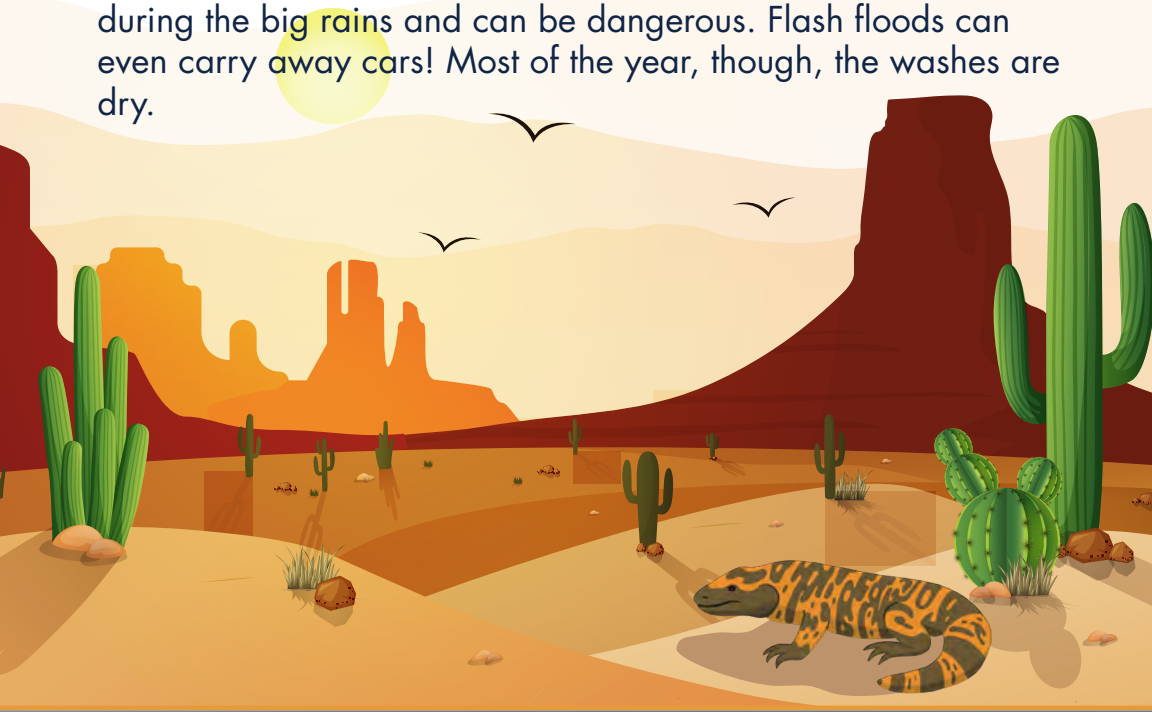
There are several different kinds of deserts. a) The Sonoran Desert in Arizona is a semiarid desert. b) The Sahara Desert in Africa is a hot desert. c) Antarctica is a cold desert. The map above shows the locations of where deserts are found on earth.



# DESERT LANDSCAPES

Deserts have a variety of landforms. Mountains can be formed by volcanic activity. Then, over thousands of years they can be worn down by water. Bits of rock and soil are worn away by water and carried to other places through **erosion**. The **deposition** of these rocks and soils creates different landforms.

Even though there isn't a lot of rain in the Sonoran Desert where Gila monsters live, water has shaped the land. Occasional monsoon rains have worn down the mountains. These heavy rains create "washes." These are channels that fill with water during the big rains and can be dangerous. Flash floods can even carry away cars! Most of the year, though, the washes are dry.



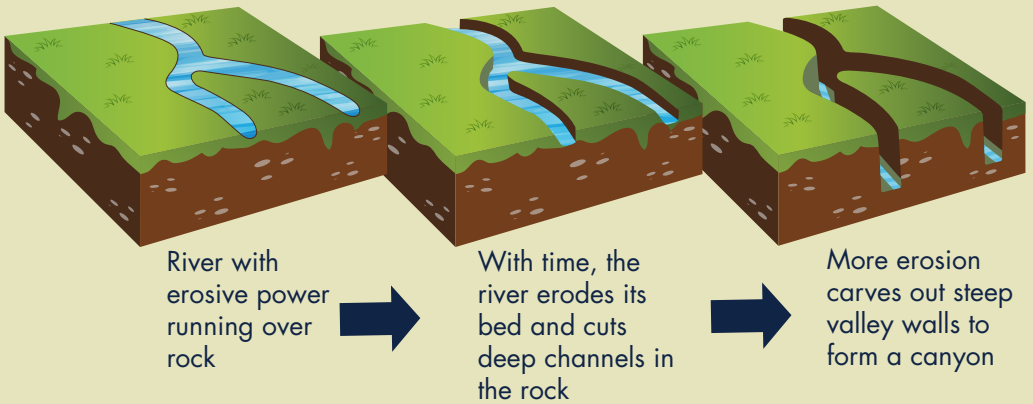
A wash in the Sonoran Desert.

# THE GRAND CANYON



Over time, water can create amazing landscapes. For example, the Grand Canyon was created by water wearing through the rock for around 17 million years!

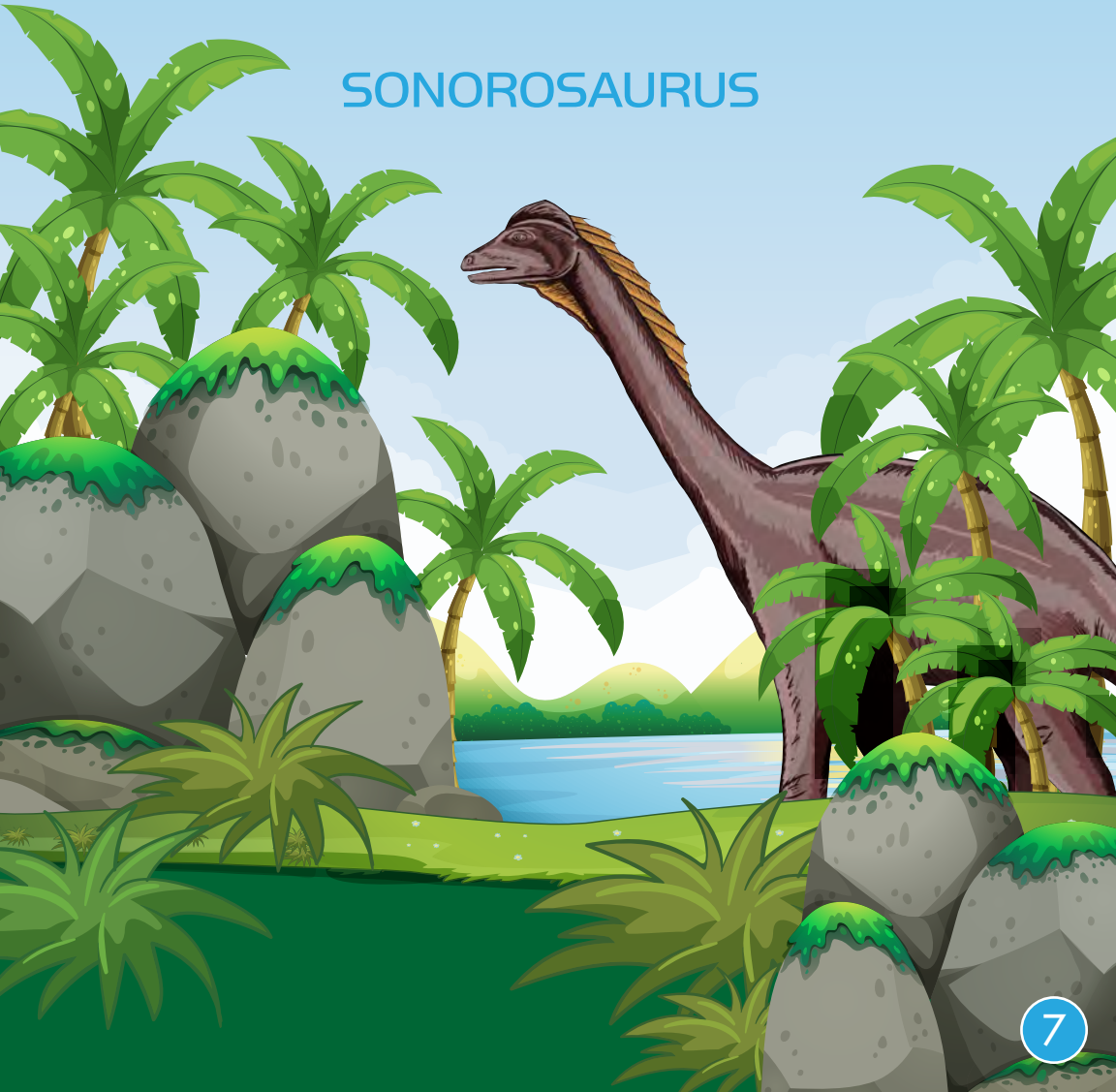
## CANYON FORMATION





Landscapes and ecosystems can change through time. Scientists study layers of rocks to see what an environment used to look like. They also use the fossils found in the rocks. The Sonoran Desert of Arizona, where Gila monsters live, wasn't always a desert. How do scientists know? They found fossils of a huge dinosaur called *Sonorasaurus*. There is no way a dinosaur that big could have lived in a desert because there would not have been enough food. Studying fossils of plants shows that millions of years ago this was a much wetter environment with enough plants to support populations of *Sonorasaurus*.

## SONOROSAURUS



# FINDING YOUR WAY

Getting around desert landscapes can be very challenging. To learn more about Gila monsters, some serious desert exploration is necessary. One tool people can use to find their way around is the Global Positioning System (GPS). GPS uses satellites in space to tell exact locations. But, what happens if the GPS unit runs out of battery power? It's important to have a backup plan!



Maps are important tools for getting around and learning more about an area before visiting it. **Topographic maps** can provide important information about **elevation**, the location of rivers, streambeds and other landforms, and the vegetation in an area. Combined with a compass, maps can help people navigate and explore.

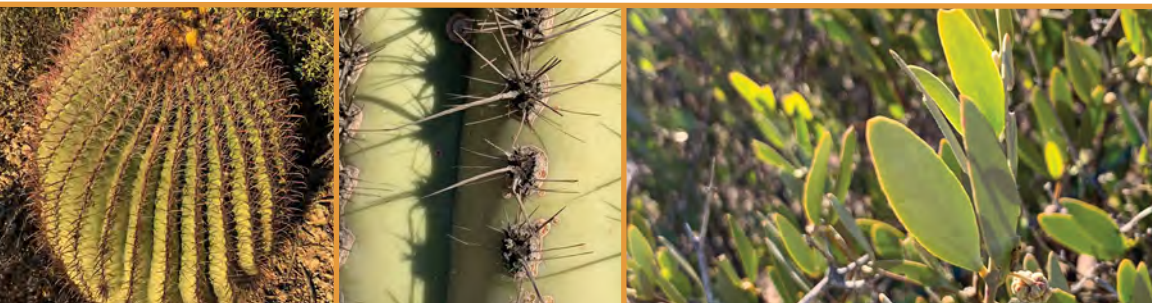


# BUILT FOR THE DESERT

Different deserts have different types of plants and animals. Locations with more rain have more plants. Gila monsters are found mainly in semiarid deserts like the Sonoran Desert of Arizona. In these deserts there is some rain each year. Most of the rain occurs during one short period in the late summer. The rest of the year there isn't much rain, so plants and animals have to be able to survive with little water. In the Sonoran Desert, animals and plants also have to be able to survive incredibly hot summers. They also need to be able to stay warm, since during the winter months there may be a freeze and even snow!

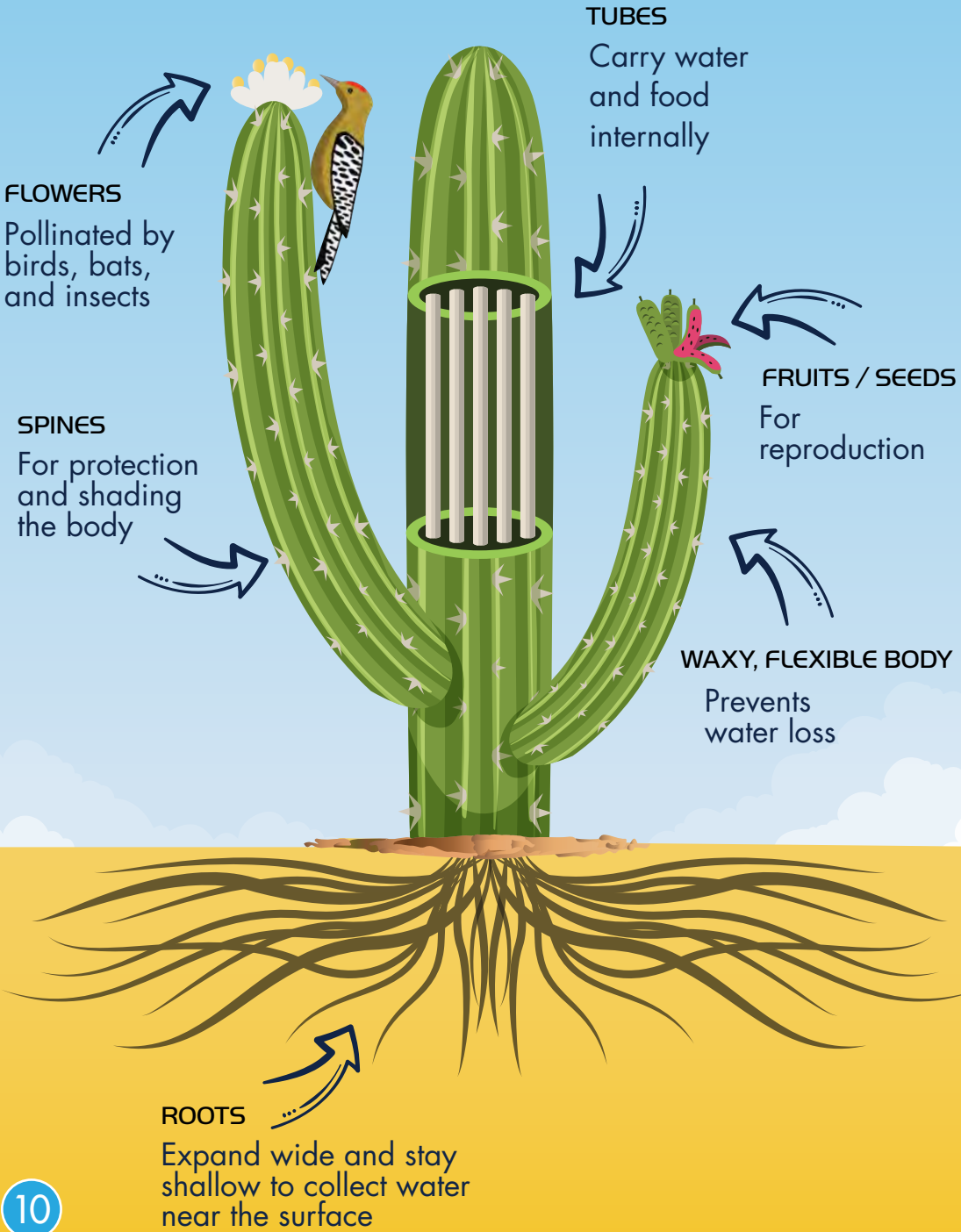


Without plants, there would be no food in the desert to support the animals. Desert plants have many of the same structures that plants in other ecosystems have. But, the shapes and types of these structures are different to help them survive the challenges of the desert.

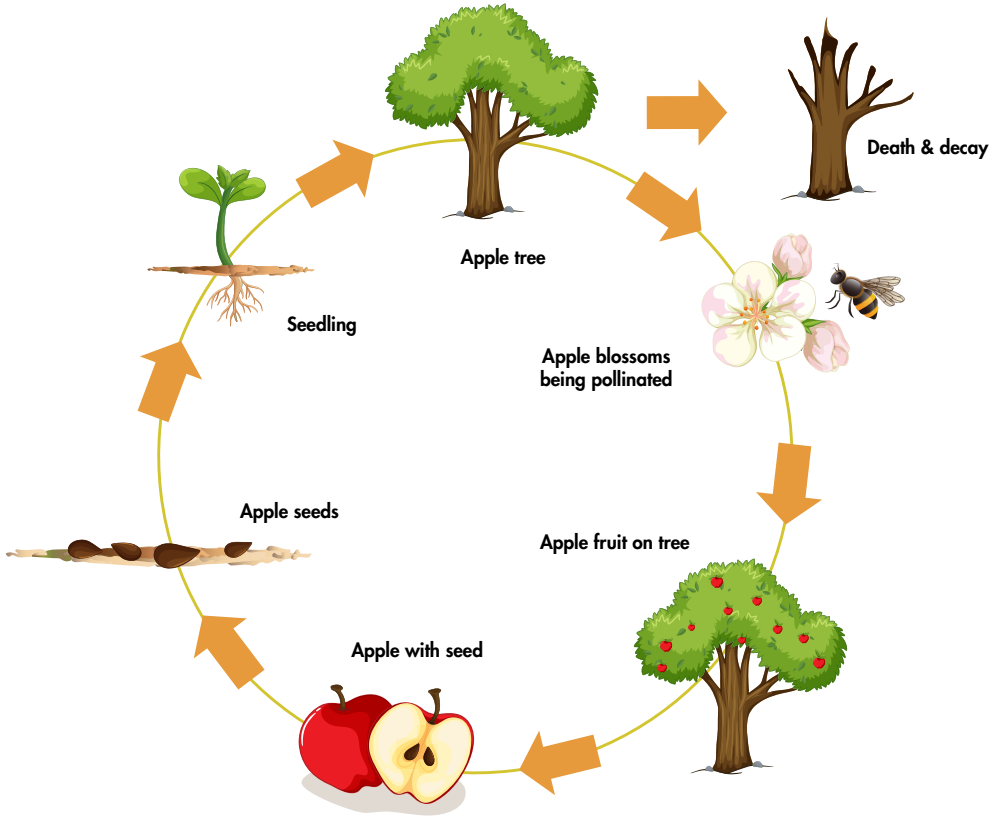


Many desert plants have unique features to help them survive in harsh climates. Fat bodies lose less water; spines provide shade and protection; and waxy leaves retain water.

# SAGUARO CACTUS



# LIFE CYCLE OF AN APPLE TREE



Many plants, like apple trees, reproduce when their flowers are pollinated by insects. The flowers become fruits which carry seeds. Once in the ground, seeds sprout into seedlings, which grow to become adult trees, and start the cycle again.



To make a seed, an egg needs to be fertilized with pollen. Some plants spread their pollen in the wind (a). Bright flowers (b) attract hummingbirds and insects like bees. The animal gets a meal, but it gets covered in pollen (c) that it takes to another plant. The pollen falls off and fertilizes an egg.

# DESERT ANIMALS

Desert animals, like Gila monsters, are adapted to their environment. Some of the structures that help them survive are external. Others are internal. For example, kangaroo rats don't need to drink at all! They can make their own water from the seeds they eat. Other animals have kidneys that help keep water in the body.

## HARRIS'S HAWK

Great eyesight to see prey

Beak to tear food



Lives in groups that hunt together



Wings to move/fly quickly



Talons to hold onto prey or the top of a cactus

# SCORPION

Stinger/Venom  
to defend from  
predators and  
subdue prey

Exoskeleton  
to keep from  
drying out;  
protects body

Pincers to  
grab prey  
and feed

# KANGAROO RAT

Special kidneys  
to save waste

Enhanced  
hearing to  
detect predators

Long tail  
for balance

Cheek pouches to  
collect food

Huge feet for  
quick movement  
and leaping

# GILA MONSTER

Color to blend in and warn predators

Fat deposits in tail store energy

Urinary bladder carries extra water around

Bony scales for protection

Claws for digging and climbing

Venom for defending against predators

Tongue for detecting chemicals



# LIFE OF A GILA MONSTER

Gila monsters like to live in places where there is enough shelter. In fact, they spend most of their time in underground burrows or under rocks. They like these shelters because it keeps them from getting too hot. There is also more moisture.

Female Gila monsters lay between four and six eggs in the summer. They bury their eggs deep in a burrow and then walk away. The eggs hatch about four months later. The young stay underground for several months before they emerge. This keeps them safe from predators and other dangers they will face on the surface.

As soon as they hatch, baby Gila monsters can fend for themselves. They already have venom! It takes Gila monsters between three and five years to reach maturity. They can live for 20 years or longer.





Gila monsters are usually **solitary**. They live alone most of the time. Sometimes though, they will share burrows. Males fight each other during the mating season. These fights are usually wrestling matches instead of major battles. That way, neither male is likely to get hurt.



# NAVIGATING THE DESERT

Life in the desert isn't easy. Gila monsters need to find enough food and water. During most of the year they have to worry about not getting too hot. But during the winter, they may need to keep from getting too cold. One way to survive is to find the right place to live. Gila monsters are only found in areas where there is enough water. If there isn't enough water for shrubs to grow, then there won't be enough water for Gila monsters to survive. Finding enough water may not be easy. Gila monsters usually stay in the same area for many years. That way, they learn the locations of food and water sources. If these change, the Gila monster might have to move or they may not survive.

The places where Gila monsters live don't have water for many months at a time. How do Gila monsters survive? When there is enough water, they drink a whole lot of it! They can store this water in a special internal sac called a urinary bladder. It's like having a built-in water bottle!

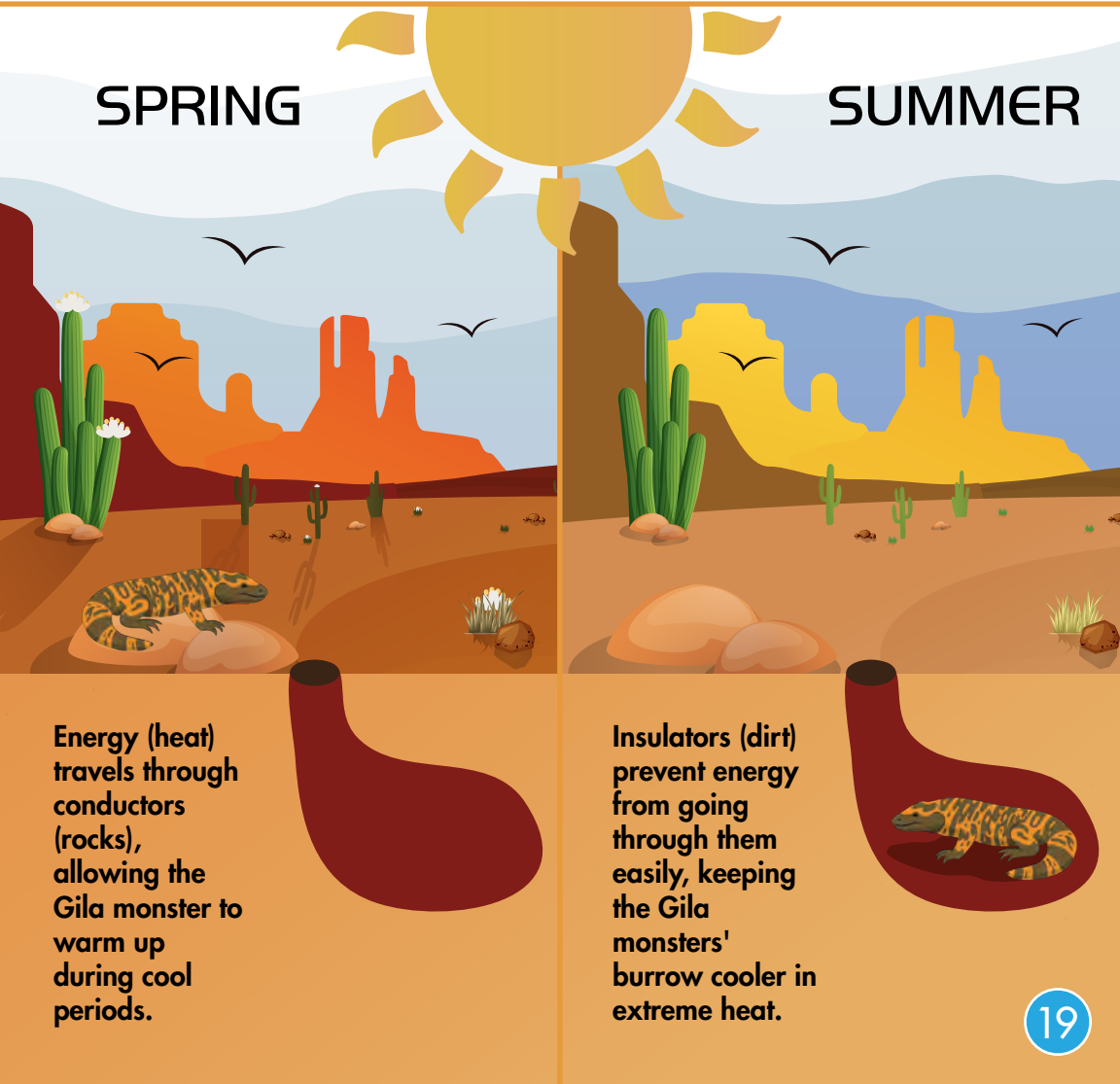


A Gila monster can live for months without drinking once it has had enough water to fill its bladder!

Even with a built-in water bottle, Gila monsters can't lose too much water. Like all lizards, they are cold-blooded. That means their bodies are usually the same temperature as the environment around them. They can only survive if their body temperature is just right. How do they keep their bodies from getting too hot or too cold? The best way is to choose the right place to spend time. And the right place to be depends on how energy, in this case heat, moves through matter.

Most of the year, it is too hot for Gila monsters to be out in the sun during the day. It is cooler in the shade where the sun doesn't directly heat them, so the lizards stay under cover. They can also head underground. Dirt is a good **insulator**. That means that heat doesn't travel through it very well. The ground around a burrow keeps the air in it cooler in summer.

Gila monsters also change when they are active based on the temperature changes. When it is too hot during the day, they stay in their burrow and come out at dawn, dusk, or during the night. When it is cooler, Gila monsters need to warm their bodies up to be able to move around. To do this, they can bask in the sun. They can also sit on warm rocks. The rocks are **conductors** of heat. That means heat travels into objects or organisms that touch the rocks. So, a Gila monster sitting on a rock during the day gets heated from the sun on its back and the rock on its belly! Can you think of times you use conduction or insulation to stay warm or cool?



# WHAT'S FOR DINNER?

Gila monsters are predators. They eat other animals including small mammals, birds, frogs, small lizards, and insects. Gila monsters also scavenge, which means they eat dead animals. Their favorite foods are bird and reptile eggs. Gila monsters have a very good sense of smell that helps them find food. They can't run very fast, but they are great diggers. They use their claws to dig up nests.



Eggs are the Gila monsters' favorite food.



Gila monsters use long claws to dig.

Gila monsters can survive for a long time without eating. In fact, they may only have to eat five to ten times each year. But, when they do eat they can eat almost 30% of their body weight. That's like a person eating 20 hamburgers in one sitting! Gila monsters have very strong jaws and an impressive bite. When they bite their prey, they won't let go! They swallow their prey whole, but may break eggs open if they are large.

# VENOM!

The Gila monster is the only venomous lizard native to the United States. Venom is a toxic substance injected by animals. It is mostly used to immobilize prey.

Gila monsters eat eggs and prey that are not dangerous. Why would they produce venom if they don't need it to catch prey? Scientists think that Gila monsters use their venom to stay safe from predators. Coyotes and hawks would love to catch and eat a Gila monster. Their venom may keep them off the menu!



Gila monsters don't inject their venom with fangs.  
It flows along grooves in their teeth.



A Gila monster's color pattern helps them blend into the rocks of the desert when viewed from far away. Up close, it serves as a warning to predators that Gila monsters are venomous!

Many animals that are poisonous or venomous have bright colors. These colors warn predators that they might get sick or get a nasty bite if they attack. Scientists think the bold colors of Gila monsters warn their predators that they are dangerous! Color isn't the only warning Gila monsters give. When they are threatened, they will open their mouths and hiss.

Gila monster venom is very potent, but they don't produce very much of it. Their bites can be painful, but the venom usually cannot kill an adult person. That hasn't stopped people from making up stories and myths about Gila monsters. There are rumors that they spit venom, jump to attack, and can kill with bad breath! None of these are true.

Gila monster venom may actually *help* people. Many chemicals in nature can be used to make medicines. Scientists are studying the chemicals in Gila monster venom. One chemical found in Gila monster venom helped scientists create a treatment for diabetes. Other chemicals are being tested to see if they could help scientists create drugs to cure other diseases.



# A CHANGING WORLD

Gila monsters are a threatened species. That means that if they are not protected, they might disappear from the wild. The biggest threat to them right now is habitat loss. People are turning the lizards' desert homes into places for agriculture or cities. It is important to protect enough habitat for Gila monsters and other desert animals and plants to survive.

Changing **climate** is another challenge for Gila monsters. Scientists think that the Sonoran Desert will get hotter and have less rain. If it gets too hot, Gila monsters might not be able to find places where they can survive. How will they survive long periods without water? Will the stress make them sick? Gila monsters may have to move to new areas to prevent extinction. Scientists are working to find out how a changing climate might influence Gila monsters in an effort to help these amazing venomous reptiles!

# STUDYING GILA MONSTERS

Biologists have been studying Gila monsters for many years. Some are interested in the chemistry of their venom. They want to know how it works and how it might be used to help develop new medicines. Other biologists want to know more about the lizards themselves and how they manage to survive in harsh environments.



Dr. Karla Moeller has been studying how Gila monsters survive, how they use their habitats, and how their health might be affected by stress. Eventually she wants to be able to predict how climate change might affect the health of Gila monsters if there are longer, hotter, and drier periods in the desert.



### Dr. Karla Moeller studies Gila monster health.

To study Gila monsters, she puts special tracking devices in them. She plots where they go and what landforms and habitats they frequently visit. She uses special instruments to see inside their bodies to measure how much water they are carrying. And, she measures the chemistry of their blood to learn about their health. Karla and other Gila monster biologists even trained some lizards to walk on a treadmill to measure their energy use.

Now you are ready to join Karla and the team to study Gila monsters!





# GLOSSARY

## **CLIMATE**

weather conditions in an area over a long period of time

## **CONDUCTOR**

a substance that transmits heat, electricity or sound

## **DEPOSITION**

the settling of soil or rocks in an area after being moved by wind or water

## **DESERT**

a dry area with little rainfall or snow

## **ELEVATION**

the height above sea level

## **EROSION**

the gradual wearing away of soil, rock, or land by wind or water

## **HABITAT**

the place an animal or plant lives

## **INSULATOR**

a substance that does not easily allow the passage of heat, electricity or sound

## **NATIVE**

naturally occurring in a place

## **PREDATOR**

an animal that catches and eats other animals

## **PREY**

an animal that is eaten by other organisms

## **SOLITARY**

living alone

## **TOPOGRAPHIC MAP**

a map showing the physical features of an area

## PHOTO CREDITS

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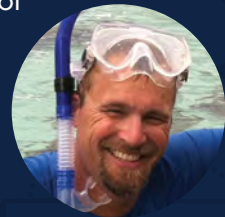
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# SCIENCE 3D

Thanks for exploring with us! Our science adventures take us around the world to uncover secrets of the most amazing animals and places. Our mission and passion is to share these scientific discoveries with you. There are so many cool things to see out there, even in your own backyard, so get outside and explore!

## MIKE HEITHAUS PH.D.

Dr. Mike Heithaus is a scientist, explorer, author, educator, and television host. He is a professor of biology and Dean of the College of Arts, Sciences & Education at Florida International University. Mike and his students study sharks, whales, sea turtles, and other large marine animals around the world. They also work with people to help protect these species. Mike loves sharing his work with others. He has written text books and helped create programs for students in elementary, middle, and high school. He has been on television programs including on PBS, National Geographic, and Discovery Channel's Shark Week.



## PATRICK GREENE

As a wildlife filmmaker, Patrick has always had a passion for animals. He started to draw pictures of sharks and whales when he was just five years old. Later, he went to college to become a marine biologist and learned a lot about science. Then he got a job in television and learned how to make videos, too. Since then, he's gone all over the world studying and filming wild animals. He's made shows for National Geographic, PBS and ABC, and even won an Emmy Award. He loves making videos to teach students about science and about the many creatures that share our world.





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