

PIONEER EDITION

NGPIONEER.ORG

MARCH 2010

# NATIONAL GEOGRAPHIC Explorer!



## Fantastic Frogs <sup>2</sup>

Incredible Iceland 10

Cooking with Glass 16

**Reading Strategy:** As you read, ask yourself questions about frogs. Then try to answer your questions.

# Fanta



© NIM TAYLOR/NATUREPI.COM

stic

With bulging eyes and long legs, frogs are really fun to watch. Leap into the world of fantastic frogs.

# Frogs

By Leslie Hall



**Y**ou are deep in a rain forest in South America. You're looking for one of the deadliest animals on Earth. Suddenly, you see a spot of gold skin! You move toward it, but not too close.

Now the creature is hopping toward you! Hopping? Yes. It's a tiny frog, no bigger than a quarter.

For a small animal, this frog has a big name. It is called the *terribilis*, or "terrible one." It can kill with a single touch. You back off ver-r-ry slowly.

Okay. Maybe this wasn't such a good idea. Don't give up, though. There are many other frogs to see around the world. Most are much less dangerous. You can find them almost everywhere—even your backyard.



© GERRY ELLIS/MINDEN PICTURES

*This is a *terribilis*. Don't touch! It has a deadly poison on its skin.*



© THOMAS MARENZ/ARDEA.COM

## Amazing Makeover

Frogs are **amphibians**. They are born from eggs. Most frogs lay their eggs in water. When an egg hatches, a tiny tadpole wriggles out. It has gills. These are special body parts that help it breathe in water.

Soon the tadpole goes through a **metamorphosis**. That's a major makeover. Small legs and arms form. Lungs replace the gills. The tail disappears. The tadpole is now a young adult frog. It heads to land.



Some frogs carry their tadpoles to pools of water between leaves.



This male frog carries tadpoles on his back. He will take them to a stream where they'll grow into froglets.

© PIOTR NASKRECKI/MINDEN PICTURES

## Piggyback Parents

Many tadpoles never become adult frogs. Snakes and other predators like to eat them. Luckily, frogs know a few survival tricks.

Watch what the strawberry dart frog does. She lays her eggs on dry ground. When the eggs hatch, she takes each tadpole to a bromeliad plant. Pools of water collect between the plant's leaves. The frog drops the tadpole into a pool. This watery hideout may keep the tadpole safe.

A few days later, the mother returns. She lays a special egg in each pool.

The egg provides food for the tadpole.

Some frog fathers help out, too. The green poison dart frog is one example. The male waits until the eggs hatch. Then the tadpoles wriggle onto his back. Some sticky stuff holds them there. The father frog takes them into a stream. The sticky stuff melts into the water. The tadpoles slip into the stream. Off they go!

## Got Water?

Most frogs need water. Even the African painted reed frog. But this frog has to survive a dry season. To stay cool, its dark color turns white.

It also sits very still to save energy. It sits and sits and sits. A month or two goes by. Then the rains finally come. The frog's skin soaks up the water. It turns from white to dark again. Then it hops away. Wow!

## Big Peepers

Frogs have amazing eyes. A frog can see to the front, to the side, and even behind its body. That helps it spot danger—or tasty insects.

That's not all. A frog's eyes help it swallow. When a frog eats, it blinks. Blink! Blink! The eyes press down on the roof of the frog's mouth. This pushes food down the frog's throat.



*Large, bulging eyeballs let frogs see in many directions.*

PETE OXFORD/MINDEN PICTURES/  
NATIONAL GEOGRAPHIC STOCK

## It's All About Looks

Of course, not all frogs are alike. The Brazilian gold frog is smaller than a dime. Then there's the goliath frog from West Africa. It can weigh up to three kilograms (six pounds). That's a lot of frog!

Have you heard of the pink-bellied harlequin frog? How about the orange speckled mantella frog? And, oh, the glass frog is a clear favorite. You can see its skeleton and organs right through its skin! Glass frogs are hard to spot, though. You'd have to be lucky to find one.

## Calling All Frogs

Most frogs aren't hard to hear, though. They croak or ribbit. Some even quack, whistle, or scream. Can you guess what the bird-voiced tree frog sounds like? Right! A singing bird. A frog in Borneo makes a sound our ears can't even hear!

Some frogs live near loud waterfalls. The water drowns out their sounds. That makes it hard to attract a mate. So instead of croaking, the frog does a wild dance. It kicks out one long leg. Then it kicks out the other. It wiggles its feet and webbed toes. What a show for the female frogs!

MICHAEL & PATRICIA FOGDEN/MINDEN PICTURES/NATIONAL GEOGRAPHIC STOCK



A male frog makes loud sounds by filling its vocal sac with air.



© DR. MICHELE READ/SHUTTERSTOCK

The spots on its skin helps an Amazon leaf frog blend in with the rain forest.

Some frogs can jump up to 20 times the length of their bodies.



© FRITZ BAUSCHENBACH/AGE FOTOSTOCK

## It's Not Easy Being Green

Frogs are **sentinel species**. So they are very sensitive to changes in the environment. Frogs help us know when land or water is unhealthy.

For example, water pollution can cause real trouble. Frogs absorb the polluted water through their skin. This can cause tadpoles to **mutate**. Some grow extra legs—or no legs at all. One frog had an eyeball growing in its throat.

Frogs with strange body parts are a warning signal. They tell us something may be wrong in the environment. People who live near the frogs could develop health problems, too.

## Frog Alert

Pollution and damage to habitat are big problems. Now frogs are facing an even bigger danger. It's a deadly fungus. It attacks frogs' skin.

This disease kills frogs. There is good news, though. In Panama, scientists have collected hundreds of different frogs. They keep the frogs in fungus-free cages. They feed them fresh bugs. When the scientists solve the fungus problem, they will put the frogs back in the wild.

## Who Needs Frogs?

The world needs frogs. Frogs eat a lot of insects. This controls the insect population. Many animals eat frogs. For example, birds, fish, snakes, and bats eat them. Frogs alert us to possible problems in the environment.

Doctors use poison from poison dart frogs to make pain medicine. Doctors also study the sounds of the Borneo frog to improve hearing aids.

Yes, frogs are fantastic. So grab your gear. Head out for your own amphibian adventure. Ribbit!

## Wordwise

**amphibian:** animal that can live both in water and on land

**metamorphosis:** body changes an animal goes through to become an adult

**mutate:** to grow unusual body parts

**sentinel species:** plants or animals that are very sensitive to changes in the environment







*Scientists are trying to save frogs like these from a deadly fungus.*



*When water is polluted, frogs may quickly show signs of disease.*

## Growing Pains

Sometimes, Iceland grows in sudden spurts. Just ask the people of Heimaey.

Heimaey is a tiny island off Iceland's southern coast. In 1973, red-hot lava erupted from a crack in the ground. This created a new volcanic mountain.

The eruption slowed down. Yet it didn't stop. A river of hot lava moved toward the island's only town. The brave people fought back. They got water pumps and fire hoses. They sprayed cold seawater on the hot lava.

Their plan worked! The front edge of the lava flow cooled. It hardened and formed a wall. The wall protected the town. The rest of the lava flowed into the sea. It formed new land. Now the island was one-fifth larger!

*Iceland has about 20 active volcanoes. Krafla, in northern Iceland, last erupted in 1984.*

## Sizzling Site

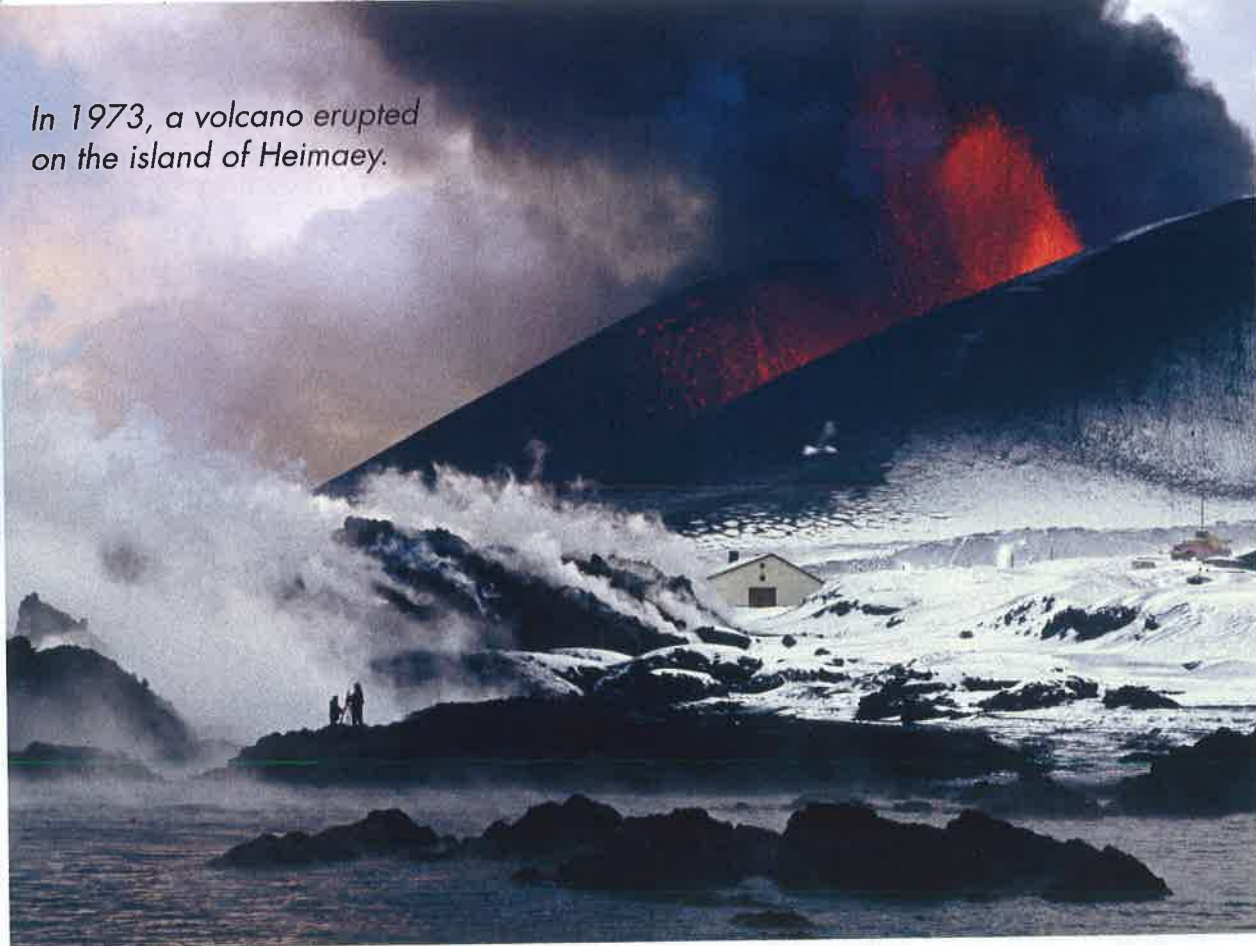
In many of Iceland's lava fields, steam rises from the ground. Iceland is covered with steam vents and hot springs. The steam comes from hot water and heated rocks inside Earth.

Blue Lagoon is Iceland's most famous hot springs. You can go there to soak in the milky blue waters. Enjoy it. The water has come a long way.

Deep beneath Blue Lagoon lies a bed of hot rock. The rock heats water from the Atlantic Ocean that seeps into the ground. People built pipes to pump the water up to the surface.

The people of Iceland find other ways to use Earth's hot water, too. Steam spins **turbines**. These engines create electricity. That heats homes and even greenhouses.

*In 1973, a volcano erupted  
on the island of Heimaey.*



EMORY KRISTOF

*Heat from under the ground creates these boiling, bubbling mud pots.*



© GIOVANNI THAMBERG/WWD WORKBENCH OF EUROPE



**Reading Strategy:** Read this story to learn how people make things with glass. As you read, think about the steps they follow.

# Cooking with

by Macon Morehouse and Patrick

# Glass

© EBERHARD GRAMMEL/REUTERS/JANISIA PHOTOS



## **McGeehan**

**It's strong, but breakable.**

**It's solid, but you can see through it.**

**Discover the secrets—and science—behind one of the most beautiful and useful things on Earth: glass.**

**Y**ou feel a blast of heat as you enter the hot shop. Liquid goo glows like lava inside a furnace. The goo oozes, smooth as honey. When it cools, it hardens—into glass.

This hot shop belongs to artist Dale Chihuly. Here, glassblowers shape hot glass into interesting pieces. Chihuly uses these pieces to make works of art.

© BUANCHE SPANTON/SHUTTERSTOCK (BACKGROUND)

## Counting on Glass

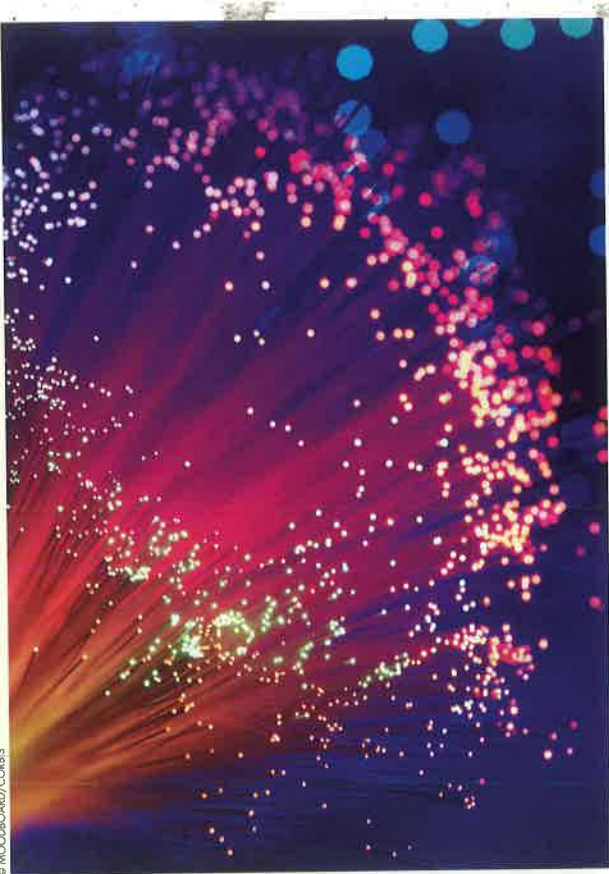
Glass is one of the most useful materials on Earth. Look around. Count all the things that are made of glass. Start with windows and lights. It's hard to imagine life without glass.

Your television, computer, and even your skateboard all have glass parts. Telescopes and microscopes have glass lenses. Glass fibers carry phone, TV, and Internet signals into our homes.



*Glass artist Dale Chihuly makes glass flow into amazing shapes.*

© MARK WILLIAM FENNY/SHUTTERSTOCK (MARBLES)



*Glass fibers, each as thin as a hair, carry data for phones, TVs, and computers.*

## The Science of Glass

Glass is useful and beautiful. Chihuly loves creating art with glass. “It is the most mysterious and magical of all materials,” he says.

Glass can be fragile. It also can be strong—stronger than steel. Cooled glass feels hard. Heat it up and it melts and oozes into different shapes.

To really cook with glass, you need science. Start with **physics**. Ask this question: How does light shine through glass? The secret lies in its **state of matter**.

*Light pouring through stained-glass windows creates colorful patterns.*

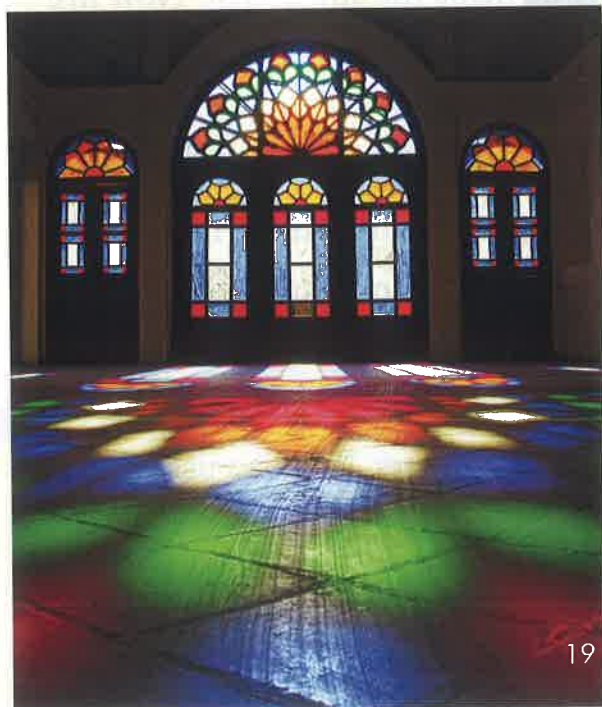
## A Pinch of Physics

Glass can be like a **solid**. It feels hard, like a rock. Its shape doesn’t change. Yet glass can be like a **liquid**, too. Hot glass flows and can change shape.

Here’s the weird part: Cool, hard glass is like a liquid, too. It doesn’t *look* like, say, running water. To see how they are alike, you have to look at invisible particles inside glass. These particles are called **atoms**.

## Running Hot and Cold

In solids, atoms pack tightly together. In liquids, atoms are scattered. The atoms in melted glass are scattered, too. As glass hardens, its atoms race to pack tightly together. Oh, no! The glass hardens too fast. Its atoms get stuck in place. Space remains between them—enough to let light through.





*Safety gear protects this person as he pours melted glass.*

VOLKER STEGER/SIEMENS/PHOTO RESEARCHERS, INC.

## A Sprinkle of Chemistry

A glass artist also uses chemistry to make glass. Here's one formula:

Take some silica. Silica is very pure sand. Then add soda. Soda is made from salt or the ashes of plants. The soda helps the silica melt. Now fire it up! You need a fire that's  $1,200^{\circ}\text{C}$  ( $2,200^{\circ}\text{F}$ ) hot.

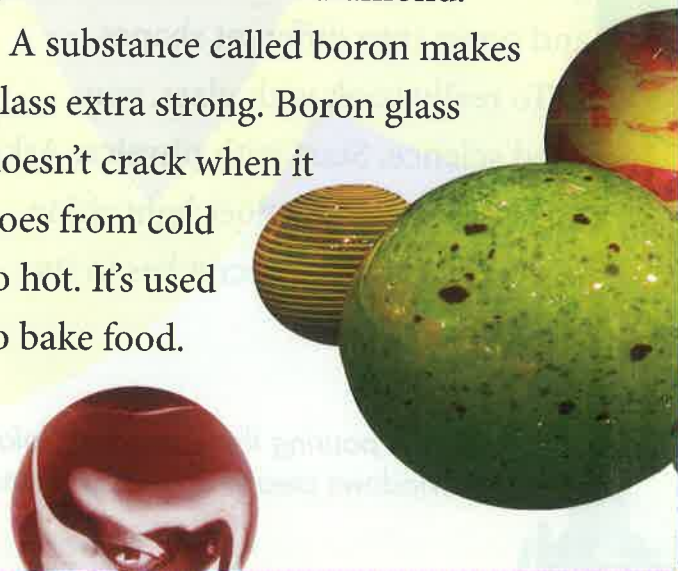
The third ingredient is a chalky powder. It's called lime. Lime makes glass strong and hard. Glass made with soda and lime is the most common. It's used for windows, light bulbs, and jars. It is also used for Chihuly's art.

## Season with Color

Now for the fun part. Want color? Throw in some different kinds of metals. Gold makes glass turn reddish. Iron makes it pale green. For an ocean blue, add cobalt.

Want sparkling clear glass? Add some lead. That makes a fine crystal glass. It shines like a diamond.

A substance called boron makes glass extra strong. Boron glass doesn't crack when it goes from cold to hot. It's used to bake food.





## And Bake

Mix everything together. Then bake on high heat. The ingredients turn into an oozing goo. It's time to turn this goo into art.

A glassblower gathers a gob of molten glass on the tip of a metal pipe. He blows through the pipe and twirls. He blows and twirls. The glass on the end of the pipe balloons out. The glass cools. It becomes thicker and sticky. The glassblower heats it up again. The glass softens. The glassblower blows and shapes again.

## The Cool Down

The piece is almost finished. It's just the right shape. There is one final step. The glass goes into a hot oven. The oven and the glass slowly cool. The glass becomes stiff and hard.

This step is very important. If hot glass cools too quickly, it explodes! Even the best glassblowers face this problem. A bigger piece takes longer to cool. You have to be patient. In the 1930s, a glass company made a mirror for a giant telescope. It took ten whole months to cool!

*Blown glass balls and flowers turn a boat into a sea of color.*



## A Window on Glass

People have been making glass for a long time—5,000 years! At first, glass objects were precious and rare. It took days to make one glass bottle.

That changed over 2,000 years ago. The Romans figured out how to blow glass. They could make cups, containers, and perfume jars in a jiffy. Glass objects became more common.

The Romans also invented glass windows. For many years, only the rich could afford them. Glass windows were a luxury.

Today, many glass items are made in factories. Every day, machines churn out light bulbs, windows, and more. They don't cost a lot. Houses, schools, and cars have glass windows. Some skyscrapers are covered in glass.

## Shattering Limits

What else can we do with glass? It seems like there are few limits. Chihuly is doing amazing things with glass art. Take a trip to the Indianapolis Children's Museum. Check out his sculpture there.

A twisting, candy-colored tower rises 13 meters (43 feet) into the air. Swirling shapes float in the ceiling above the tower. It took 5,000 pieces of glass to make this sculpture. It is called "Fireworks of Glass."

Scientists are pushing the limits of glass, too. How about a glass submarine? Maybe you'll ride in one someday. Imagine an airplane with glass wings! Someday you may fly in one. Glass is an ancient material. Yet today, we are still cooking with glass!



*Ancient Romans blew these glass objects.*