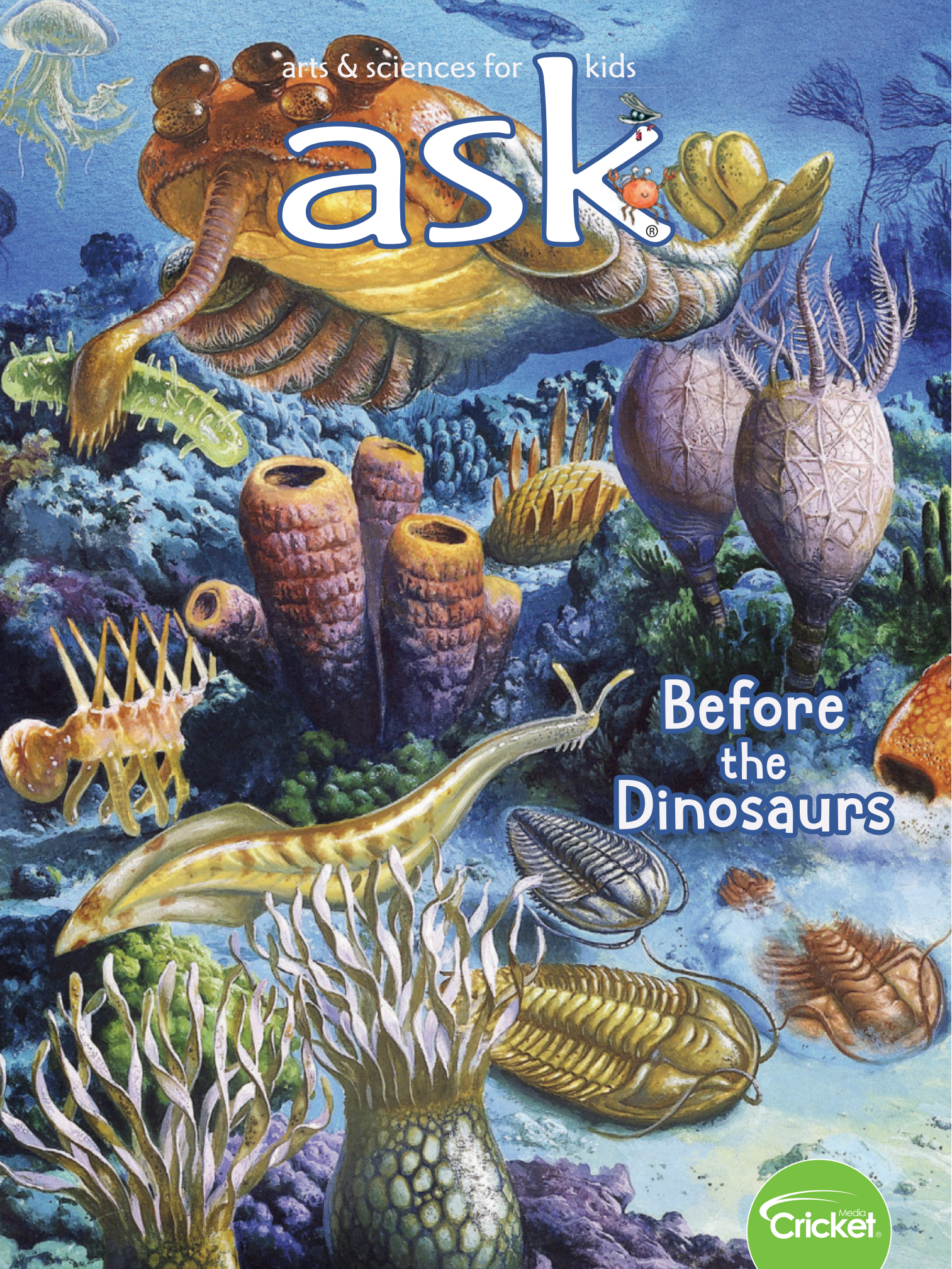

arts & sciences for kids
ask®
Before the Dinosaurs
Cricket Media

arts & sciences for kids

ask®

Volume 19, Number 4 April 2020

ASK magazine (ISSN 1535-4105) is published 9 times a year, monthly except for combined May/June, July/August, and November/December issues, by Cricket Media, 70 East Lake Street, Suite 800, Chicago, IL 60601. Additional Editorial Office located at 1751 Pinnacle Drive, Suite 600, McLean, VA 22102. Periodicals postage paid at McLean, VA, and at additional mailing offices. For address changes, back issues, subscriptions, customer service, or to renew, please visit shop.cricketmedia.com, email cricketmedia@cdsfulfillment.com, write to ASK, P.O. Box 6395, Harlan, IA 51593-1895, or call 1-800-821-0115. POSTMASTER: Please send address changes to ASK, P.O. Box 6395, Harlan, IA 51593-1895

Grateful acknowledgment is given to the following publishers and copyright owners for permission to reprint selections from their publications. All possible care has been taken to trace ownership and secure permission for each selection.

"Fins and Fingers, Wings and Hooves," text © 2008 by Charlene Brusso; "Let's Play Stump the Scientists," text and art © 2013 by Hannah Bonner.

Photo acknowledgments: Cover: Christian Jegou Publiphoto Diffusion/Science Source; 2 (RB) Verena Wahl, (LB) Pavel Krasensky/Shutterstock.com; 3 (RB) Anselmo d'Affonseca/Cell Press; 14 (LT) iofoto/Shutterstock.com; 15 (LT), (RB), (LB), 16 (RC) Bone Clones, Inc; 15 (RC) Dorling Kindersley; 16 (RT), (RT-2) Jonathan Blair/National Geographic; 17 (RT), (LB), (RB) Neil Shubin; 22-25 (bkg) Plasteed/Shutterstock.com; 22 (LT) Nicescene/Shutterstock.com, (LT-2) Paul Juser/Shutterstock.com, (LC)Freer/Shutterstock.com, (RT) Sergiy Kuzmin/Shutterstock.com, (RT-2) Lucie Lang/Shutterstock.com, (RC) MriMan/Shutterstock.com; 23 (LC) David Roland/Shutterstock.com, (LT) Nick Fox/Shutterstock.com, (RB) Natural Visions/Alamy Stock Photo; 24 (LT) metha1819/Shutterstock.com, (TC) Katrine Glazkova/Shutterstock.com, (TC-2) Herschel Hoffmeyer/Shutterstock.com, (RT) Four Oaks/Shutterstock.com, (RT-2) zcw/Shutterstock.com, (LB) Dinghua Yang, (LC) PaulSat/Shutterstock.com, (RB) Universal Images Group North America LLC / DeAgostini/Alamy Stock Photo; 25 (TC) Dmitry Bogdanov, (LB) Warpaint/Shutterstock.com, (RB) Ralf Juergen Kraft/Shutterstock.com; 32 (RT) Dotted Yeti/Shutterstock.com, (RT-2) Morphart Creation/Shutterstock.com.

Printed in the United States of America
From time to time, *Ask* mails to subscribers advertisements for other *Ask* products, or makes its subscriber list available to other reputable companies for their offering of products and services. If you prefer not to receive such mail, write to us at *ASK*, P.O. Box 1895, Harlan, IA 51593-895.

1st Printing Quad Sussex, Wisconsin March 2020

Teacher guides available for all our magazines at cricketmedia.com/teacher-resources

Suggested for ages 7 to 10.

page 14

Who's got your arm?

Departments

Who's on the cover?

Opabinia

Echinoderms
related to sea urchins

Pikaia, the first vertebrate

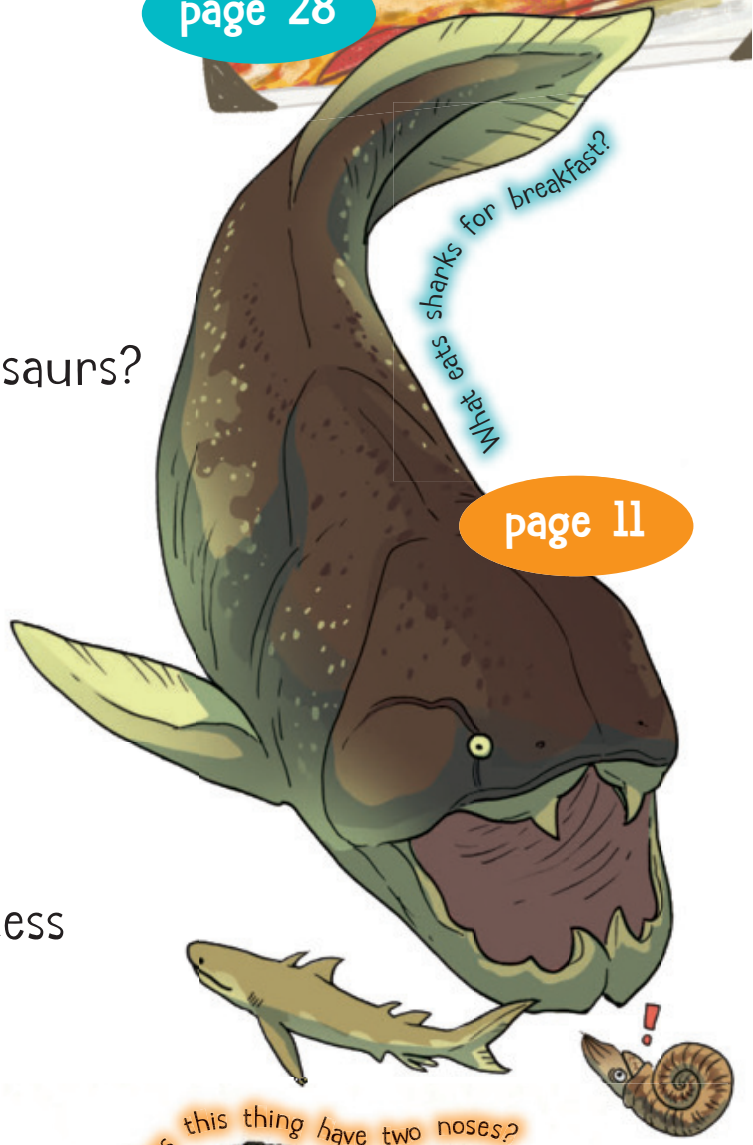
Trilobite tribe

. . . and friends

CONTENTS

page 28

Features



page 11

page 24

page 18

Nosy News

by Elizabeth Preston

Hot-Foot Ants

A shiny little ant in Africa is the fastest ant in the world, researchers say. It has to be fast to stay alive.

The Saharan silver ant lives in the scorching hot desert. During the day, the sand can reach more than 140° F (60° C). Most animals stay out of the sun. But the Saharan silver ant darts across the sand in the middle of the day to look for food. To learn how the ants manage not to overheat, researchers took high-speed video of ants running on sandy paths.

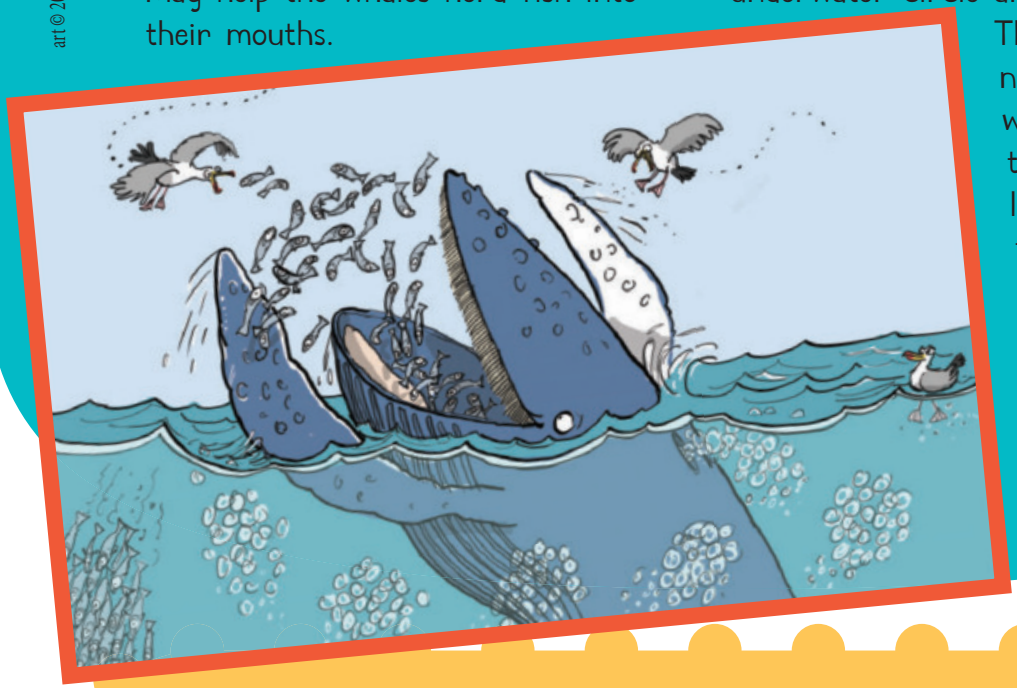
They saw that running ants move their legs three at a time: first the middle leg on one side with the front and back legs on the other side, then vice versa. This gait gives them a top speed of 855 millimeters per second (almost 2 miles an hour). That's about 108 ant body lengths every second. Relative to their size, these ants are some of the fastest animals on Earth. That fast stepping keeps them off the hot sand. Their silver shell also helps by reflecting sunlight.

Scientists set up a hot sand raceway to film the ants running.

FISHING WITH FLIPPERS

Humpback whales are some of the biggest creatures in the ocean. They also have super long flippers—much longer than other whales. Now scientists think the stretched flippers may help the whales herd fish into their mouths.

Researchers flew a drone over the ocean near Alaska. They captured photos and videos of two humpback whales hunting fish. Each whale worked on its own. They started by swimming in an underwater circle and blowing bubbles. This formed a "bubble net" around the whales' prey. Next, the whales used their long fins to push the fish together. Eventually, those fish ended up inside the whales' mouths.



SHOUTY BIRD

A bird in the Amazon rainforest may have the world's loudest song. Does it use those impressive pipes to call to faraway friends? Nope! Male birds scream at females standing right next to them.

Researchers measured the sound levels of male white bellbirds in Brazil. These birds have pretty white feathers and a weird flap of skin dangling from their beaks. Their call sounds sort of like a short fire alarm. And it's the loudest bird sound ever measured.

Male birds turned to face female birds on branches and blasted their loud songs in their faces. Scientists think this habit evolved because females actually like it.

Hear the bellbird sound off at: ebird.org/species/whibel2.

by Jeffrey Ebbeler


This looks like a trunk.
We found three heads.
Um... Do you think those might come from different animals?
Maybe a fish?
And a mammal?
These look like fossilized fern leaves.
And this is an exhaust pipe from an old car.
100 MILLION YEARS AGO
That makes more sense.
There's no way there was a dinosaur that looked the way we had imagined.
I've never seen any thing like you before.
I just evolved! I think three heads will be the new thing.

LIFE on EARTH

A Brief History

art by Mark Hicks

4.5 billion years ago

The Sun, Earth, and other planets form out of a swirling cloud of dust and gas.

Early Earth is hot and lifeless.

2 billion years ago

Oxygen made by bacteria rusts iron in the oceans and eventually escapes into the air.

For billions of years, bacteria rule the seas. Nothing grows on land.

1.5 billion years ago

About 1.5 billion years ago, some bacteria fuse to make the first complex cells.

1 billion years ago

Gradually, cells join up to make the first multi-celled creatures.

Today

65 million years ago

End of the dinosaurs

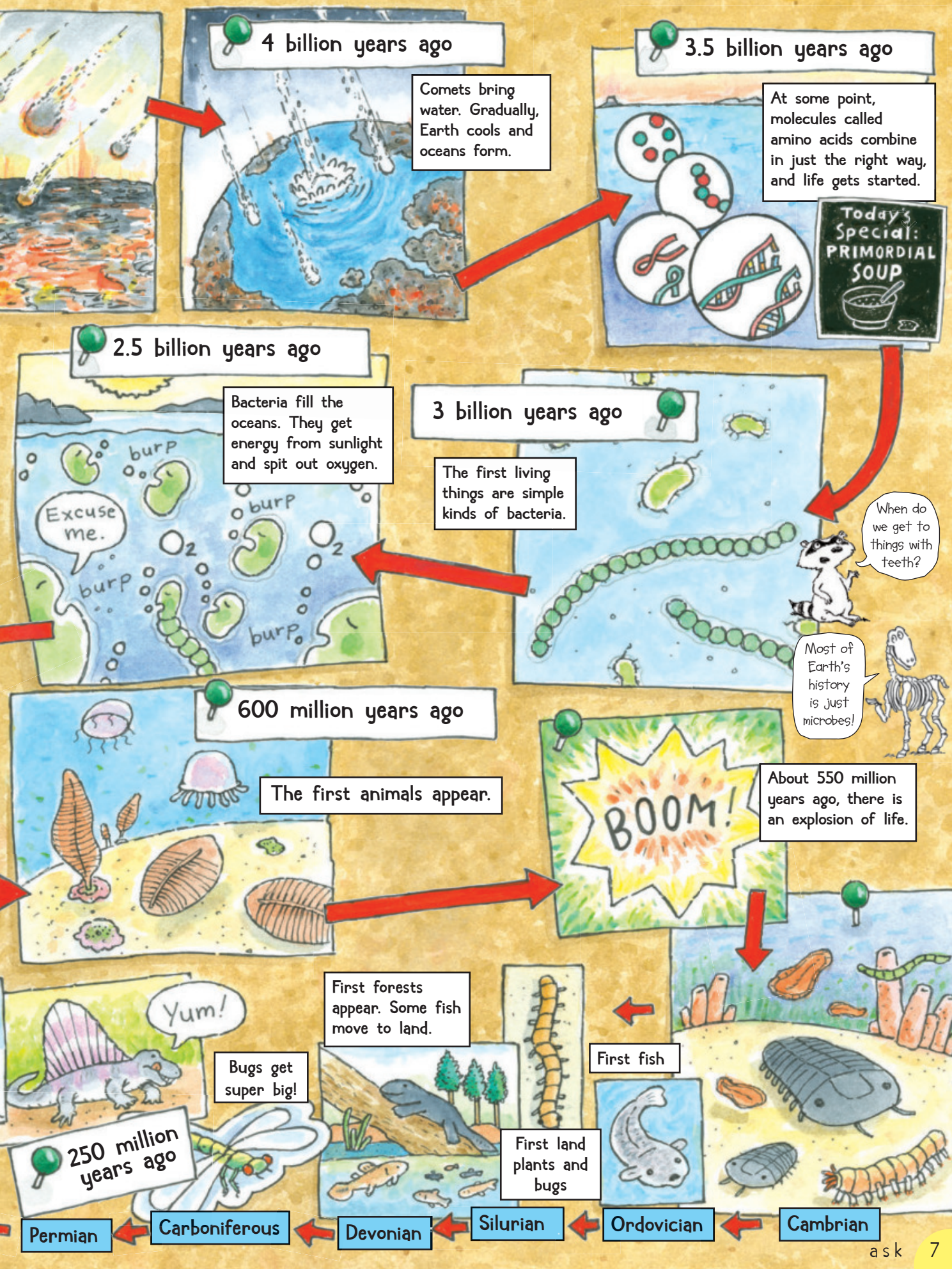
Dinosaurs, reptiles, and birds rule.

Many more mammals

Plants get flowers.

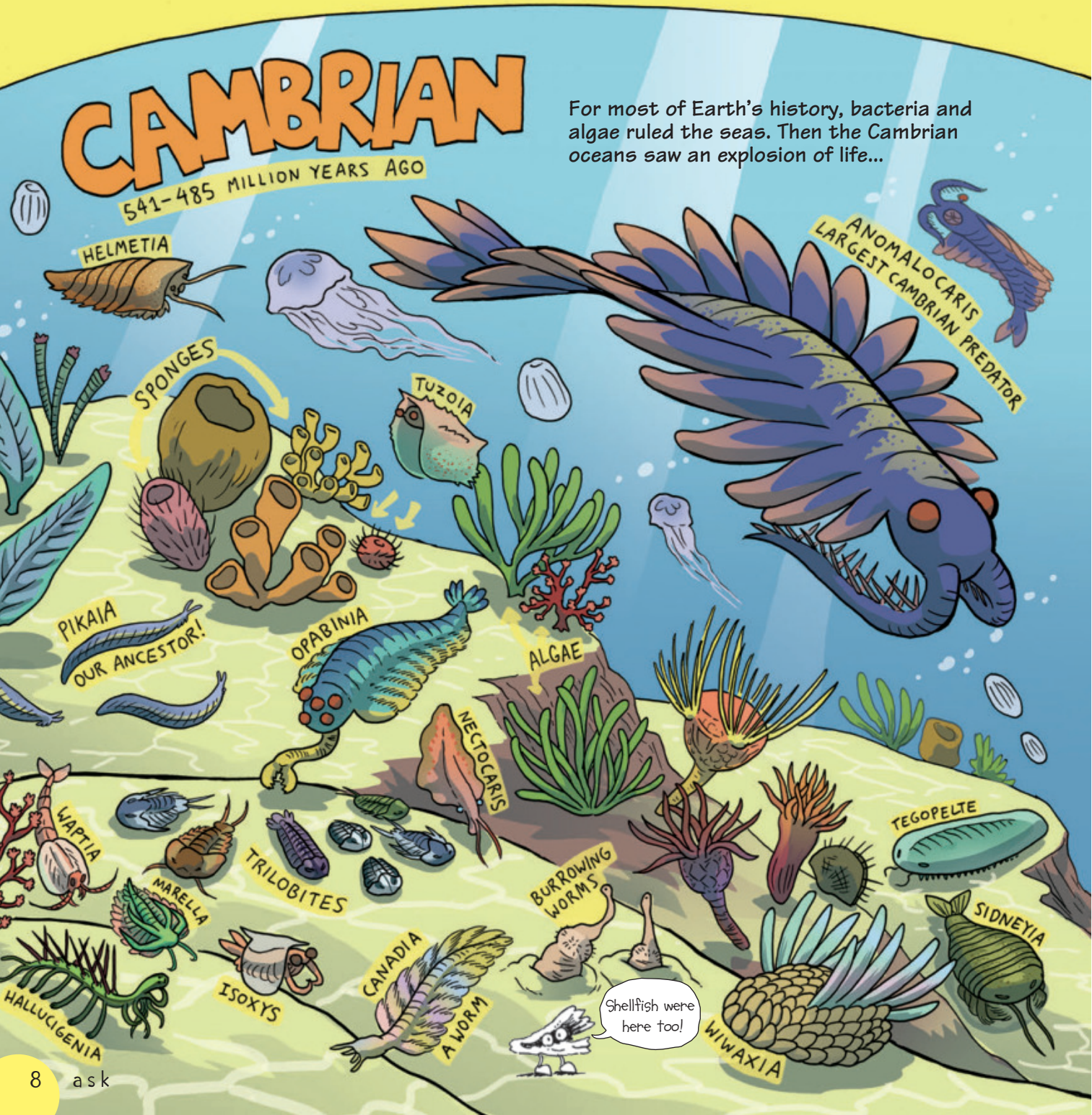
First mammals

Quaternary | Tertiary | Cretaceous | Jurassic | Triassic


4 billion years ago
Comets bring water. Gradually, Earth cools and oceans form.
3.5 billion years ago
At some point, molecules called amino acids combine in just the right way, and life gets started.
Today's Special: PRIMORDIAL SOUP
2.5 billion years ago
Bacteria fill the oceans. They get energy from sunlight and spit out oxygen.
burp
Excuse me.
O2
3 billion years ago
The first living things are simple kinds of bacteria.
When do we get to things with teeth?
Most of Earth's history is just microbes!
600 million years ago
The first animals appear.
BOOM!
About 550 million years ago, there is an explosion of life.
Yum!
Bugs get super big!
250 million years ago
First forests appear. Some fish move to land.
First fish
First land plants and bugs
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian

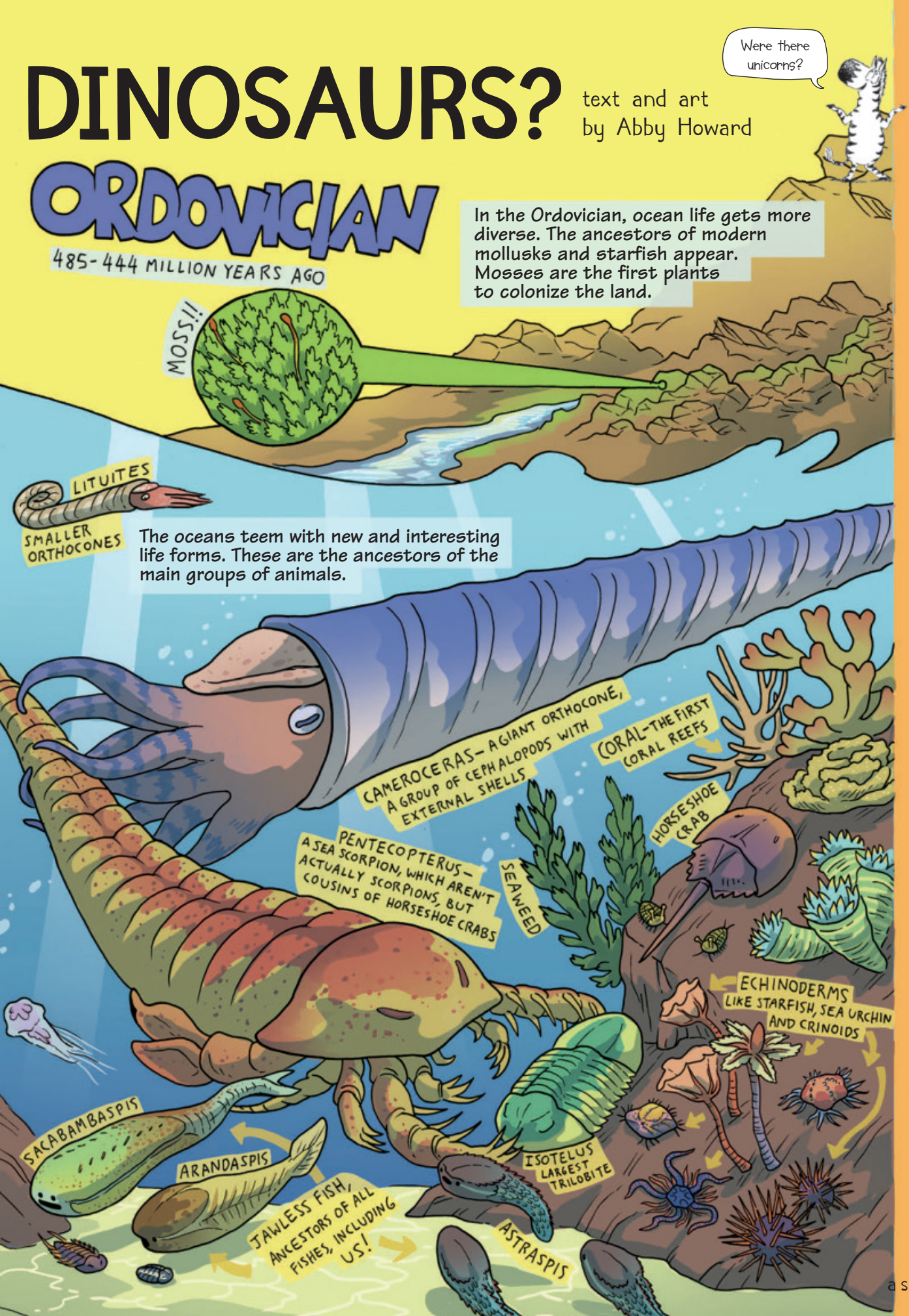
WHAT CAME BEFORE

Dinosaurs lived long, long ago—250 million to 65 million years in the past.
But dinosaurs were not the oldest living things. So what lived before the dinosaurs?
Who were their ancestors?
If we go back 500 million years, we would find a very different world.
Here is a very brief peek at six ages of life before the dinosaurs. Each of these eras lasted a long time, and life changed a lot during each.

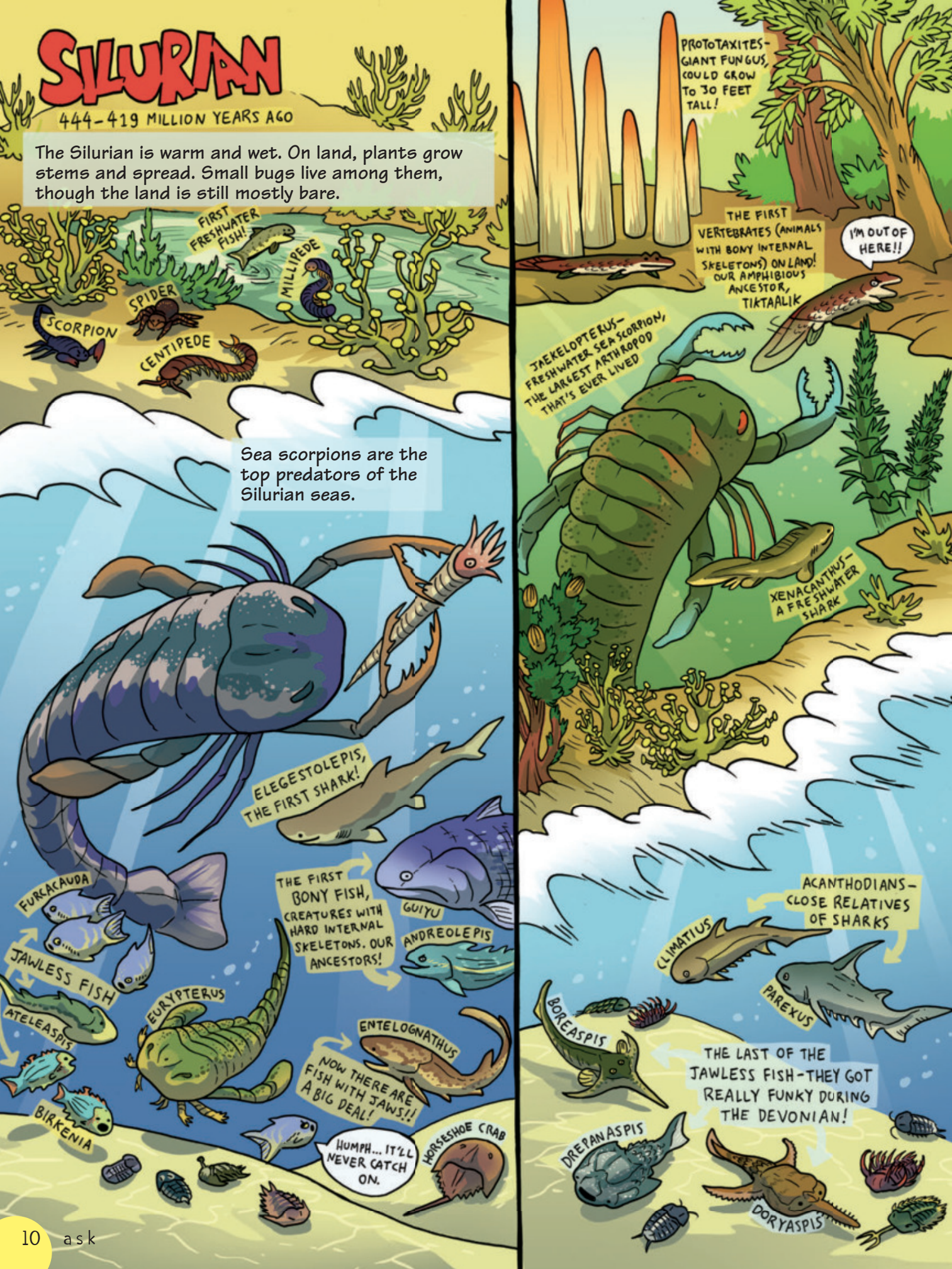


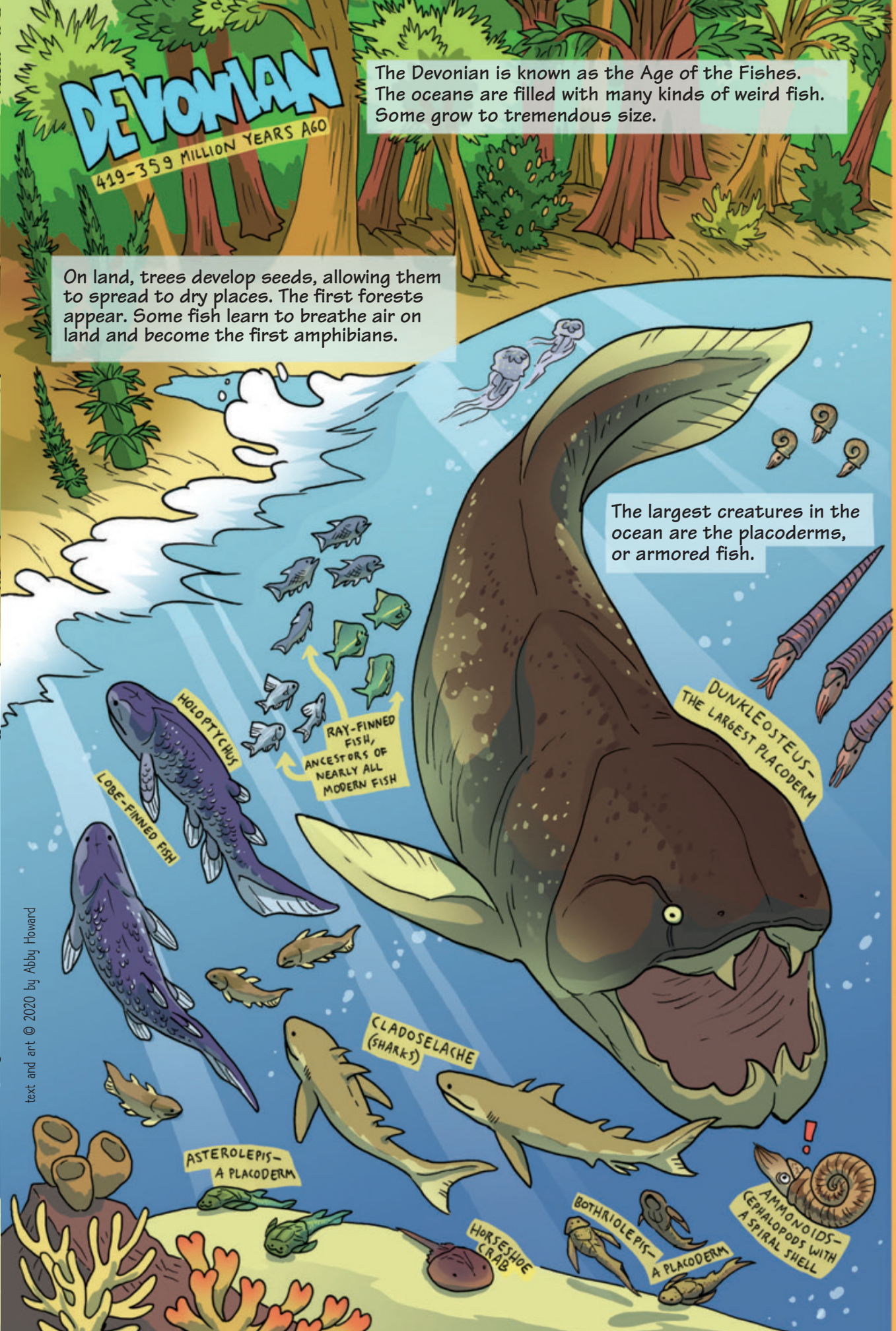
DINOSAURS?

text and art by Abby Howard

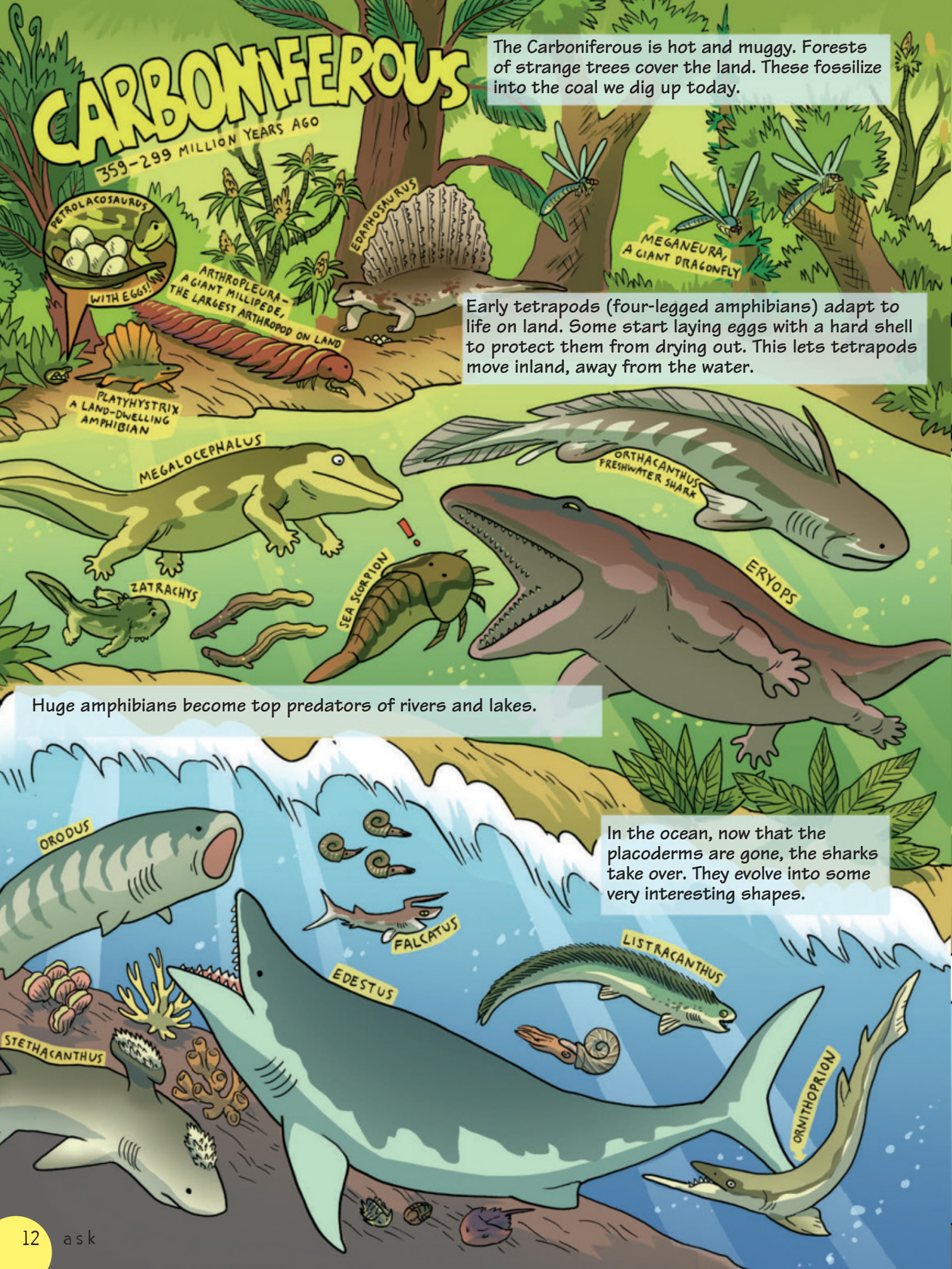


Ordovician Extinction: At the end of the Ordovician, a period of global cooling and dropping sea levels wiped out about half of ocean species.


SILURIAN
444–419 MILLION YEARS AGO
The Silurian is warm and wet. On land, plants grow stems and spread. Small bugs live among them, though the land is still mostly bare.
FIRST FRESHWATER FISH!
MILLIPEDE
SPIDER
SCORPION
CENTIPEDE
Sea scorpions are the top predators of the Silurian seas.
ELEGESTOLEPIS, THE FIRST SHARK!
FURCACAUDA
JAWLESS FISH
ATELEASPIS
BIRKENIA
THE FIRST BONY FISH, CREATURES WITH HARD INTERNAL SKELETONS. OUR ANCESTORS!
GUIYU
ANDREOLEPIS
EURYPTERUS
ENTELOGNATHUS
NOW THERE ARE FISH WITH JAWS!! A BIG DEAL!
HUMPH... IT'LL NEVER CATCH ON.
HORSESHOE CRAB
PROTOTAXITES– GIANT FUNGUS, COULD GROW TO 30 FEET TALL!
THE FIRST VERTEBRATES (ANIMALS WITH BONY INTERNAL SKELETONS) ON LAND! OUR AMPHIBIOUS ANCESTOR, TIKTAALIK
I'M OUT OF HERE!!
JAEKELOPTERUS– FRESHWATER SEA SCORPION, THE LARGEST ARTHROPOD THAT'S EVER LIVED
XENACANTHUS– A FRESHWATER SHARK
ACANTHODIANS– CLOSE RELATIVES OF SHARKS
CLIMATIUS
PAREXUS
BOREASPIS
THE LAST OF THE JAWLESS FISH–THEY GOT REALLY FUNKY DURING THE DEVONIAN!
DREPANASPIS
DORYASPIS



Devonian extinctions: At the end of the Devonian, rapid changes in climate and less oxygen in the ocean wiped out much animal and plant life, including the placoderms.


CARBONIFEROUS
359–299 MILLION YEARS AGO
The Carboniferous is hot and muggy. Forests of strange trees cover the land. These fossilize into the coal we dig up today.
PETROLACOSAURUS WITH EGGS!
EDAPHOSAURUS
MEGANEURA, A GIANT DRAGONFLY
ARTHROPLEURA – A GIANT MILLIPEDE, THE LARGEST ARTHROPOD ON LAND
Early tetrapods (four-legged amphibians) adapt to life on land. Some start laying eggs with a hard shell to protect them from drying out. This lets tetrapods move inland, away from the water.
PLATYHYSTRIX A LAND-DWELLING AMPHIBIAN
MEGALOCEPHALUS
ORTHACANTHUS FRESHWATER SHARK
ERYOPS
ZATRACHYS
SEA SCORPION
Huge amphibians become top predators of rivers and lakes.
ORODUS
FALCATUS
EDESTUS
LISTRACANTHUS
STETHACANTHUS
ORNITHOPRION
In the ocean, now that the placoderms are gone, the sharks take over. They evolve into some very interesting shapes.

Permian-Triassic Extinction: The largest mass extinction of all time, possibly caused by huge volcanic eruptions in Siberia. 70% of land species and a whopping 95% of ocean species died out. Making way for...the first dinosaurs!

Fins and Fingers, Wings and Hooves

by Charlene Brusso, art by Thor Wickstrom

Your arms and legs don't look like wings or fins. But the bones that make up arms and legs, fins, flippers, and wings all follow the same pattern. Why do animals that look very different on the outside look so similar on the inside? They have an ancient story to tell.

Animals with similar bone patterns are related. Their bones are similar because they all share a common ancestor, long, long ago.

Bones Tell the Tale

The key to this mystery lies deep in the past. Long ago, in the Cambrian oceans, one family of swimming worms developed a central nerve down their backs. All animals with backbones, or vertebrates, evolved from this common ancestor.

Over time, vertebrates evolved into many kinds of fish. About 400 million years ago, vast oceans full of fish and other creatures covered

A manatee's flipper has the same bones inside as a human hand.

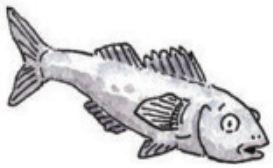
Earth's surface. One kind of fish, called the lobe-fins, had fins that were large and strong, with more powerful muscles than other fish.

As the years passed, one type of lobe-fin fish evolved fins that had one large bone connected to two smaller bones. Some lobe-fins developed limbs strong enough to push themselves out of the water and explore the edges of the sea. Being able to crawl up on land gave them a handy way to escape large predators. The land was also full of tasty bugs to eat. So the land-crawlers thrived, and some spent less and less time in the water.

Gradually, their fins changed into limbs that were useful for walking rather than swimming. They developed ankle and wrist joints. The land-walking fish became a new group of animals called tetrapods, a word that means "four feet" in Greek.

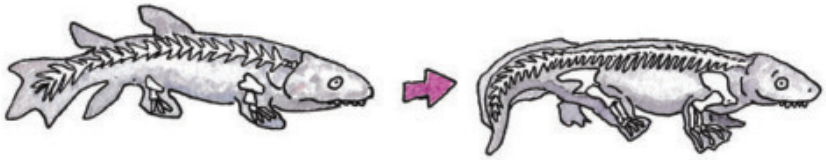
The earliest tetrapods were similar to large salamanders. Scientists think they used their front limbs to hump themselves along like seals. Their descendants evolved into all the legged and winged animals we see today. This large group includes amphibians (such as frogs), reptiles (including dinosaurs), birds, and mammals (like us). Marine mammals, such as whales and dolphins, are tetrapods too. Even snakes are tetrapods—they evolved from tetrapod ancestors, though they later lost their feet. But they're still in the tetrapod family.

Two Kinds of Fish

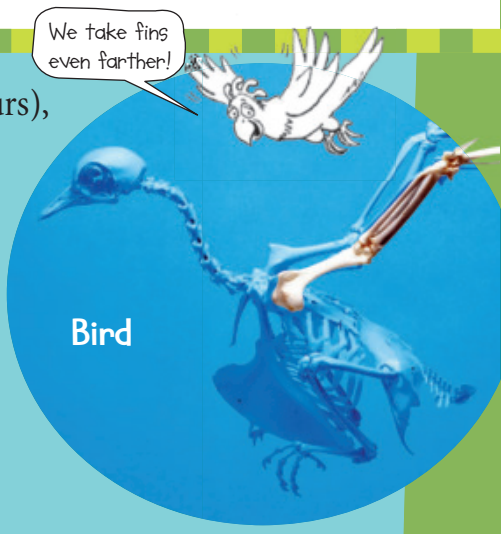


Most modern fish

Ray-finned fish have fins with flexible ribbing anchored in a thin band of bone. This is the family that most modern fish belong to.



Lobe-finned fish have strong, bony fins. Long ago, some used their strong fins to climb up onto land. They evolved into tetrapods, animals with four legs. A few lobe-finned fish still live in the oceans.

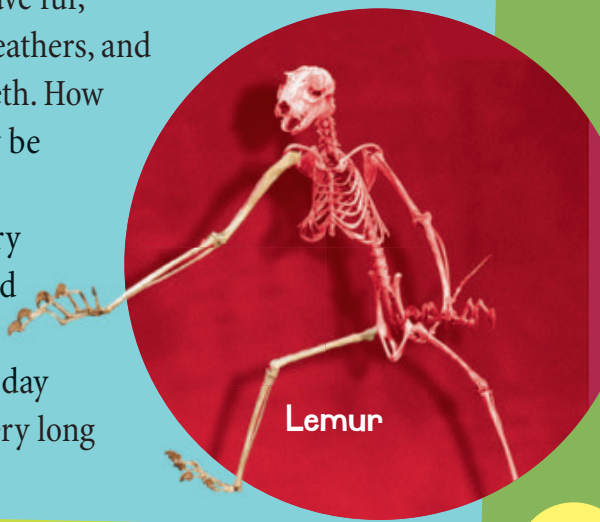


Flying birds, leaping lemurs, and lunging lizards all have the same set of bones in their limbs. Look for the single top bone, the double lower bone, and finger bones at the end.

Same Bones, Different Skin

But whales don't have fur, turtles don't have feathers, and birds don't have teeth. How could they possibly be related?

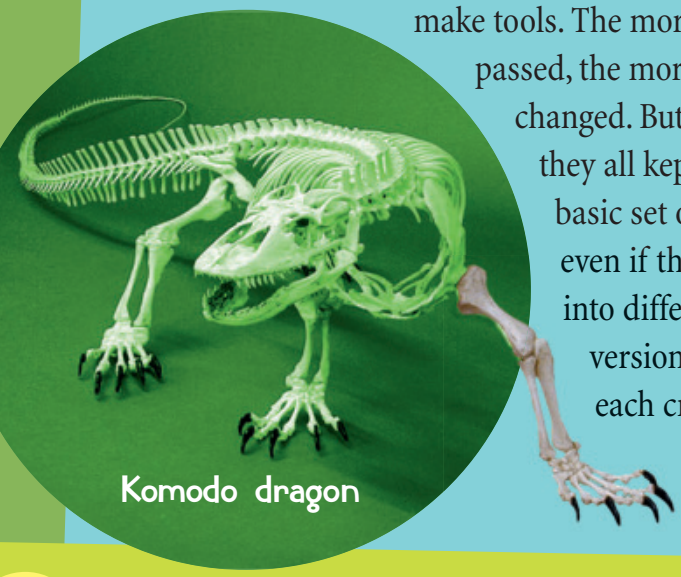
The evolutionary changes that created all the different tetrapods we see today happened over a very long



time. In every generation of animals, there's some natural variation. Some are faster, or have less hair, or grow longer teeth. The animals best suited for the environment around them tend to have more babies. And again, the offspring that are best suited do best. Over many millions of years, these changes add up.

As tetrapods evolved, some offspring had longer limbs than others. Their longer legs let them run instead of crawl. Some runners developed tough hooves to protect their feet. That helped them run faster, and some eventually became horses.

Other tetrapods developed longer front limbs, which eventually became feather-covered wings. Wings let them soar high and travel far. Still others developed claws for digging or catching prey. Some clawed animals evolved into primates with hands to grab food and make tools. The more time passed, the more tetrapods changed. But inside, they all kept the same basic set of bones—even if these evolved into different versions to suit each creature.


Komodo dragon


This ancient fossil fin has the same bones as a modern hand.

These ancient tracks were left by one of the first animals to walk on land. It may have looked like this model.


Goliath frog

All modern tetrapods are descendants of those first animals that emerged on their fins from the ancient seas. The idea that all these very different animals can be related to one another is staggering—but the evidence is there. The bones prove it.

Tiktaalik, the Fish that Walked

Scientist Neil Shubin studies the bones of ancient fish. He also knows a thing or two about human anatomy, or how the body is put together.

In 2004, Shubin led a research team to Nunavut Territory, in the Canadian Arctic. The mission? To find fossil evidence that would help scientists understand how lobe-fin fish first left the water and began to live on land.

Shubin's team made a remarkable discovery: a 375-million-year-old fossil of a creature that seemed to be half way between a fish and a land animal. Where the fins would be were bones in the pattern of a tetrapod's leg.

They named the new creature Tiktaalik, after the place where it was discovered. Tiktaalik links four-limbed life on land with its ancient ancestors in the prehistoric sea.

Neil Shubin proudly displays a model of Tiktaalik and a cast of its bones. This "fish that walked" looks a little like an alligator and a little like a fish. On land, it used its front limbs to drag itself along.

The team found the fossilized Tiktaalik embedded in ancient rock that had formed in prehistoric streams. The small circle of orange tape marks the find.

In the lab, scientists removed Tiktaalik's fossil from the rock ever so carefully.

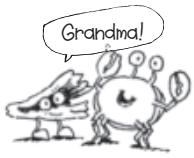
Let's Play

Stump the Scientists!

When paleontologists discover a new fossil plant or animal, they try to figure out where it fits into the tree of life, and also how it lived. Sometimes this is a piece of cake, especially when the fossil is similar to a living creature. There are ancient fossil clams, for instance, that are a lot like living clams. In this case, it's clear that they are related.

Modiolopsis, an ancient fossil clam

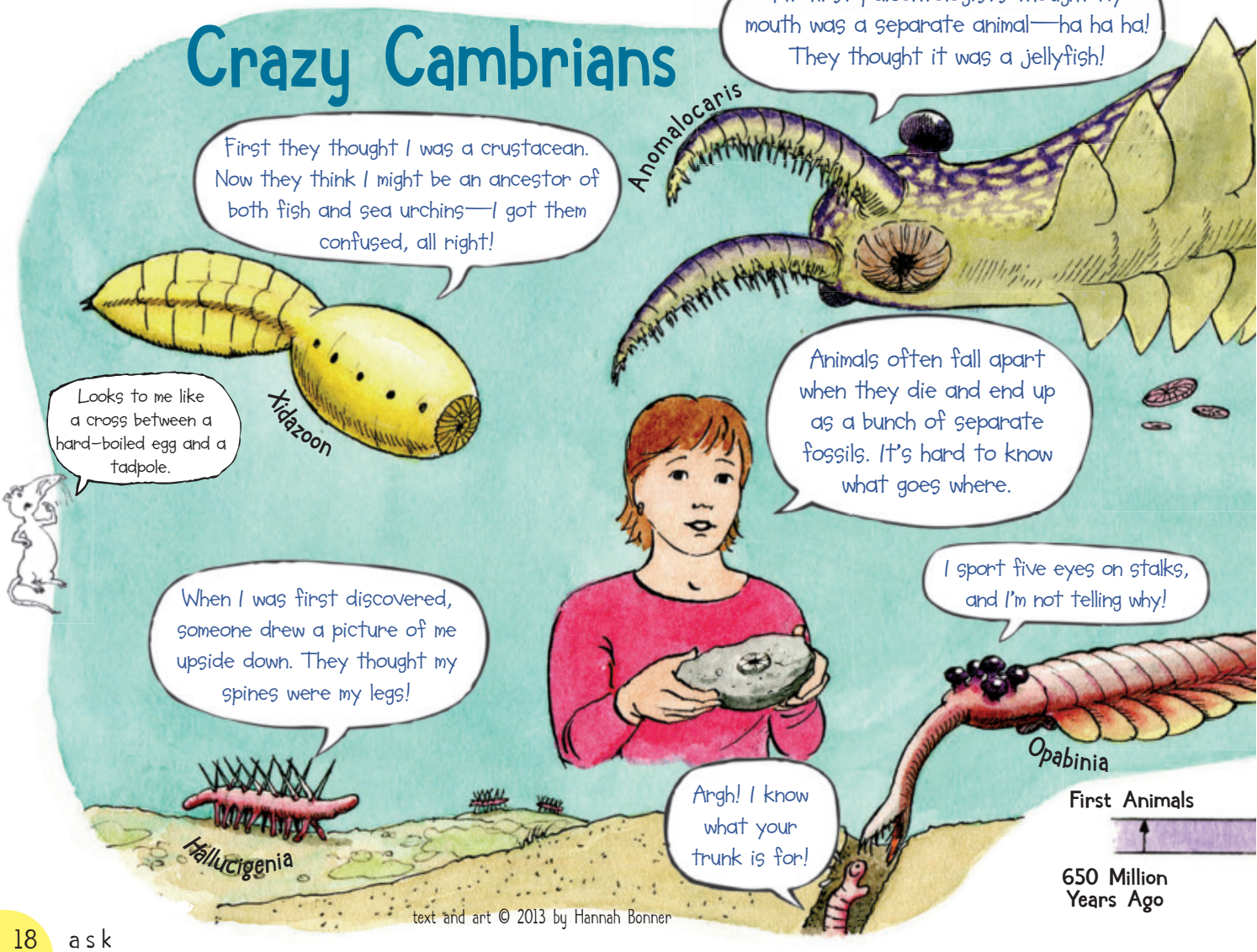
Mya, a modern clam



text and art by Hannah Bonner

Since that is not nearly exciting enough, we have invited a bunch of utterly strange creatures from long before the dinosaurs to join us and tell us how they stumped the experts.

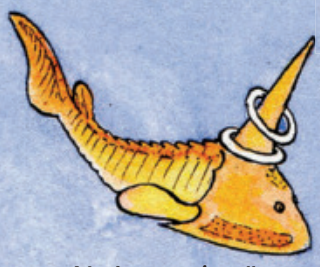
Crazy Cambrians



Freaky Fish

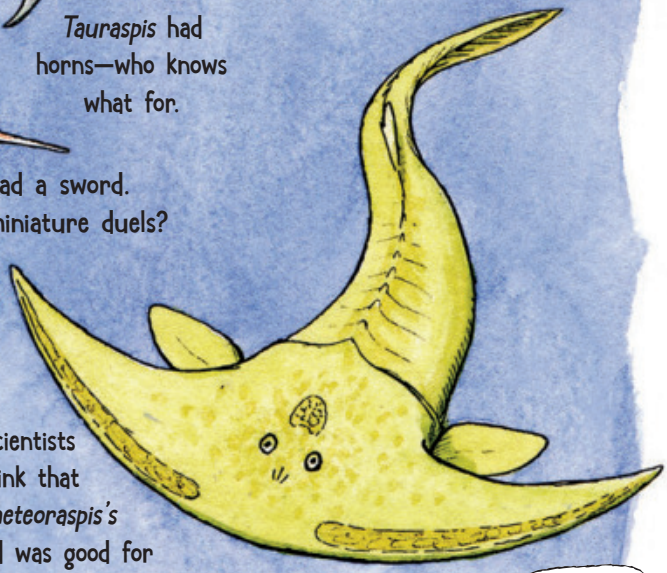
In the Silurian Period and in the beginning of the next period, the Devonian, fish without jaws were common. They had armored heads that evolved into some very odd shapes. Scientists often don't know what these odd shapes were for.

Tauraspis had horns—who knows what for.

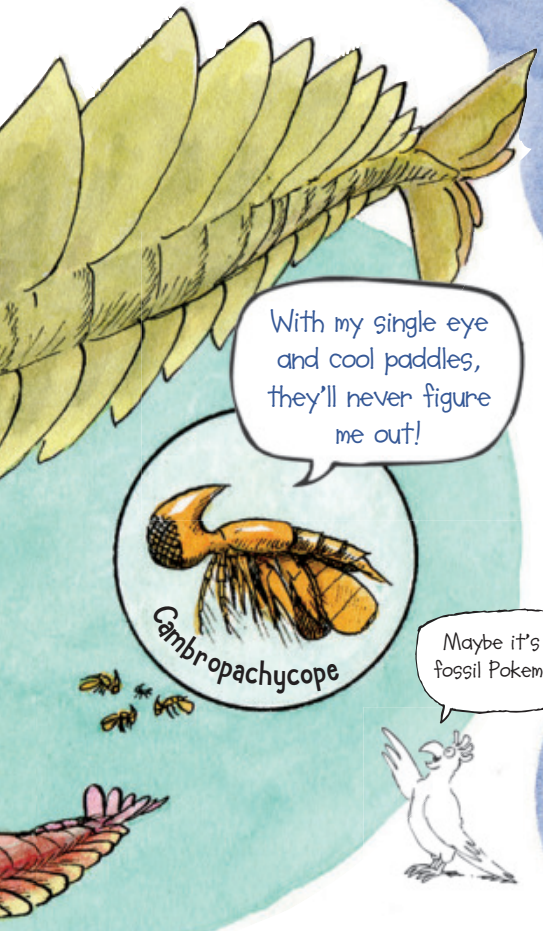


Machairaspis's tall spine probably protected it from getting eaten.

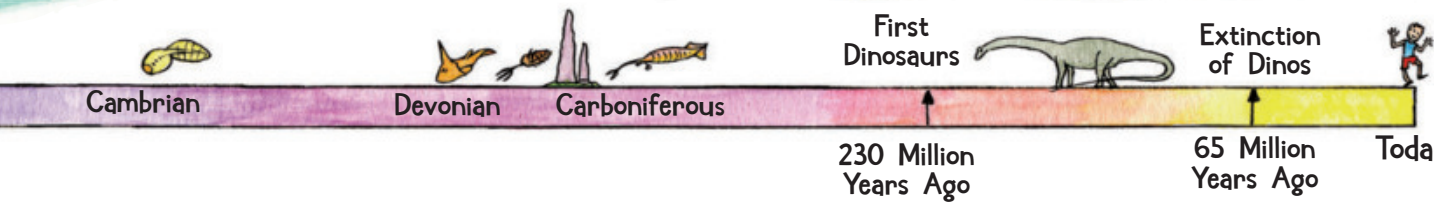
Tiny *Boreaspis* had a sword. Perhaps it fought miniature duels?



Scientists think that *Parameteoraspis*'s wide head was good for feeding on the bottom without getting buried in soft mud or sand.



Weirdest of all was *Eglonaspis:* it was essentially a flat, blind, vacuum cleaner!



Take a Bite with a Trilobite

Trilobites were common for hundreds of millions of years. This gave them time to get very creative with their spines and other body parts.

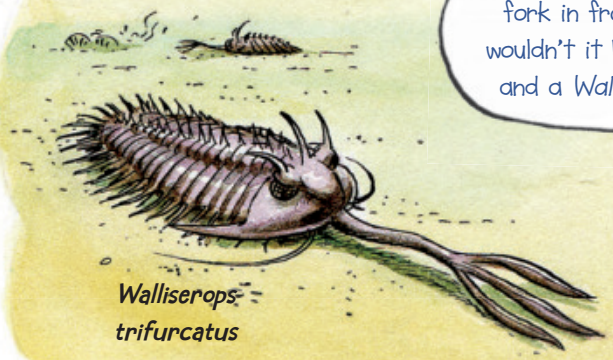

Plain trilobite


Tall eyes


Eyes on stalks


Mega spines

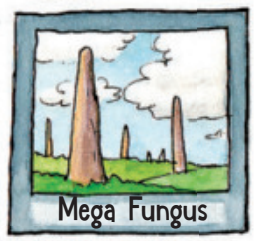

"C" shape

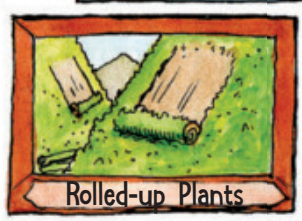

Walliserops trifurcatus

My favorite is *Walliserops trifurcatus*. It had this big fork in front of its face. We have no idea what it was for, but wouldn't it be fun if someday we discovered a *Walliserops knifetus* and a *Walliserops spoonatus*? We could set the table with them!

The Devonian Mystery Log

Once upon a time (in 1859, to be exact), a scientist found some fossil logs that he named *Prototaxites*. He assumed they were tree trunks because they had growth rings like a tree. Another scientist said they were the stems of a giant seaweed. In modern times, *Prototaxites* has been called a lichen, a giant fungus, and even a rolled-up mat of tiny plants called liverworts.





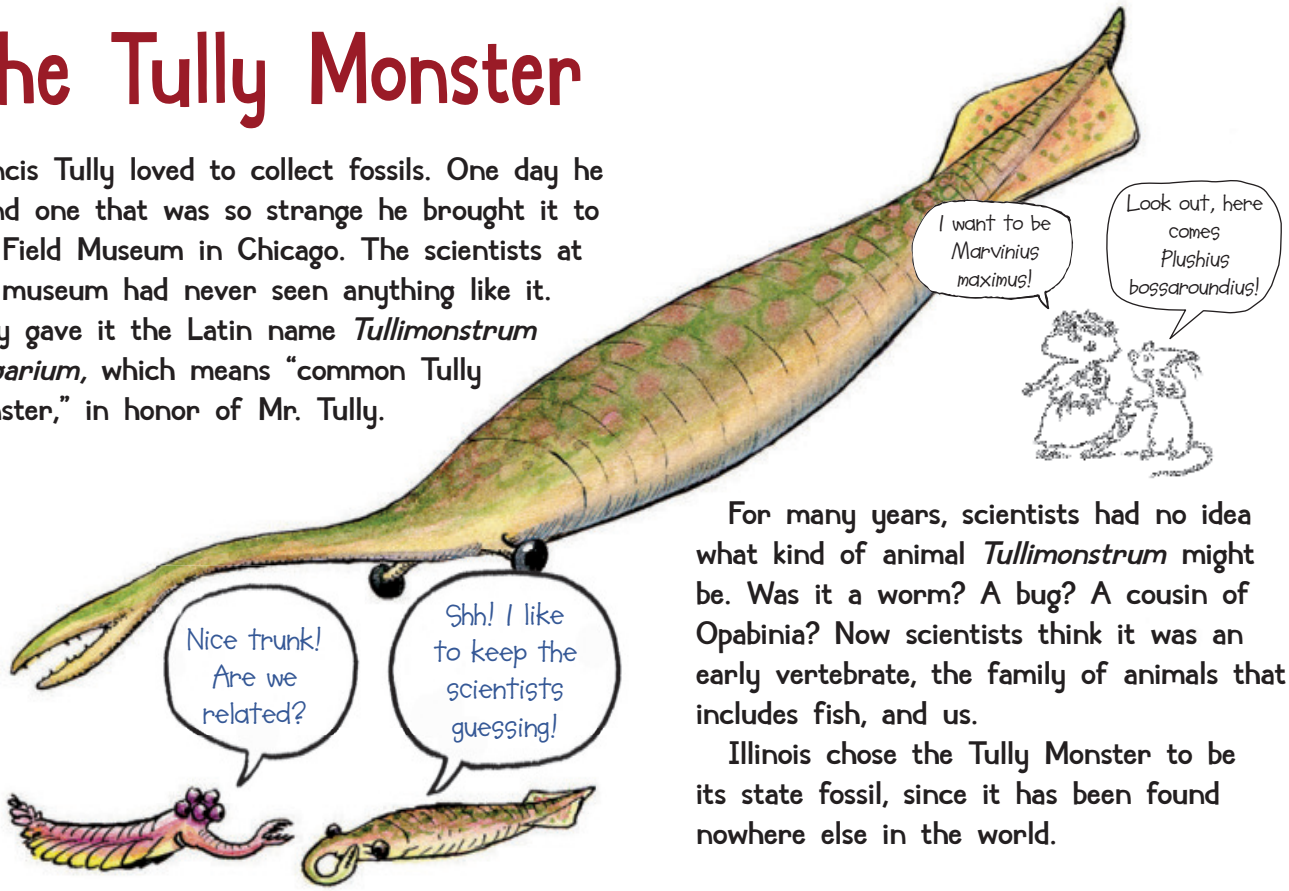
Chemical tests have shown that it probably is related to mushrooms. But it's also possible that it belongs to an extinct group that is unlike anything we know today, and that is why it's so confusing.

A roll? Wouldn't a roll look like this?

You're right. *Prototaxites* has rings, like this.

The Tully Monster

Francis Tully loved to collect fossils. One day he found one that was so strange he brought it to the Field Museum in Chicago. The scientists at the museum had never seen anything like it. They gave it the Latin name *Tullimonstrum gregarium*, which means "common Tully monster," in honor of Mr. Tully.

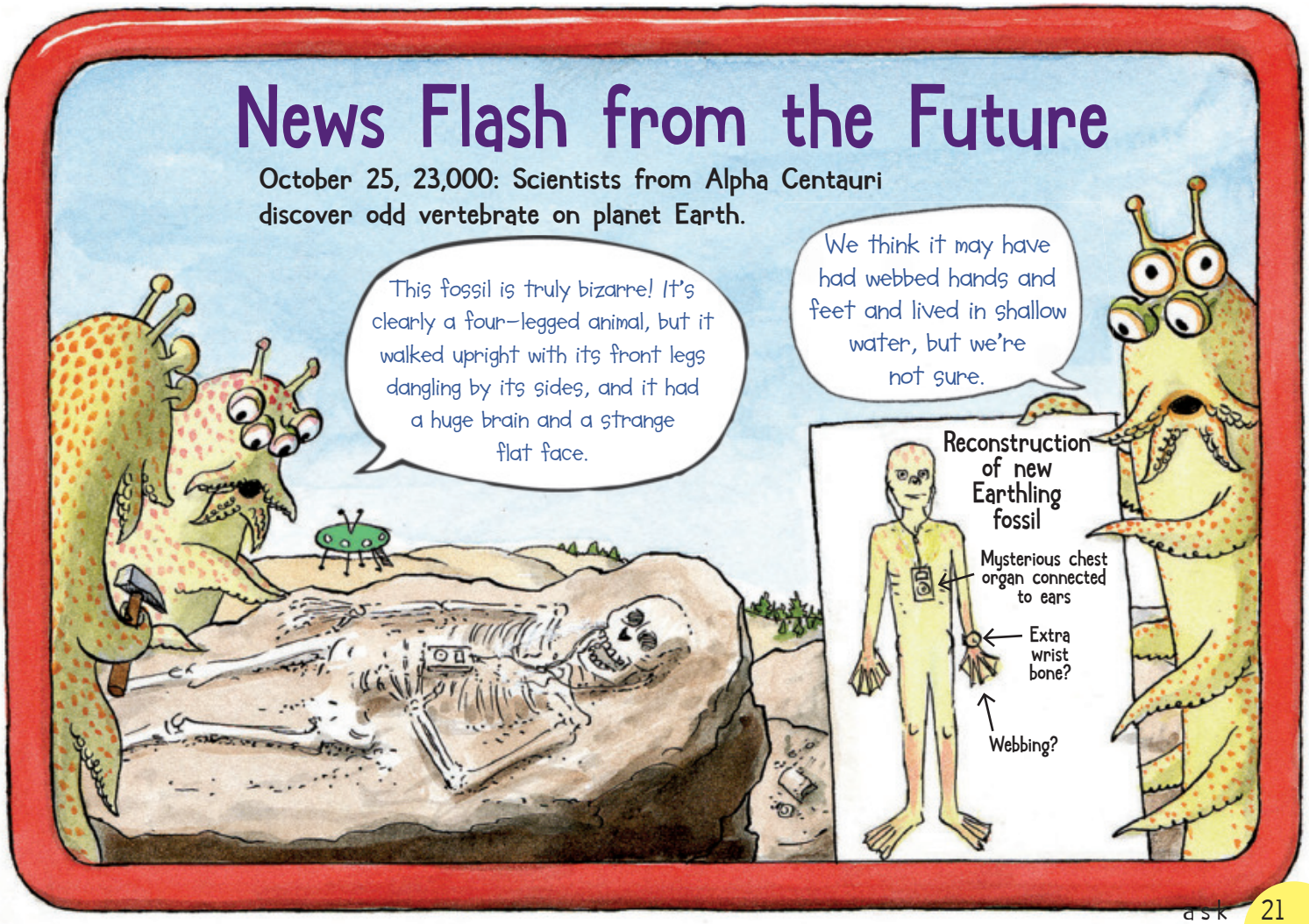


For many years, scientists had no idea what kind of animal *Tullimonstrum* might be. Was it a worm? A bug? A cousin of Opabinia? Now scientists think it was an early vertebrate, the family of animals that includes fish, and us.

Illinois chose the Tully Monster to be its state fossil, since it has been found nowhere else in the world.

News Flash from the Future

October 25, 23,000: Scientists from Alpha Centauri discover odd vertebrate on planet Earth.



I Am NOT a Dinosaur

by Sara Levine

Are there some impostors in your dinosaur collection?

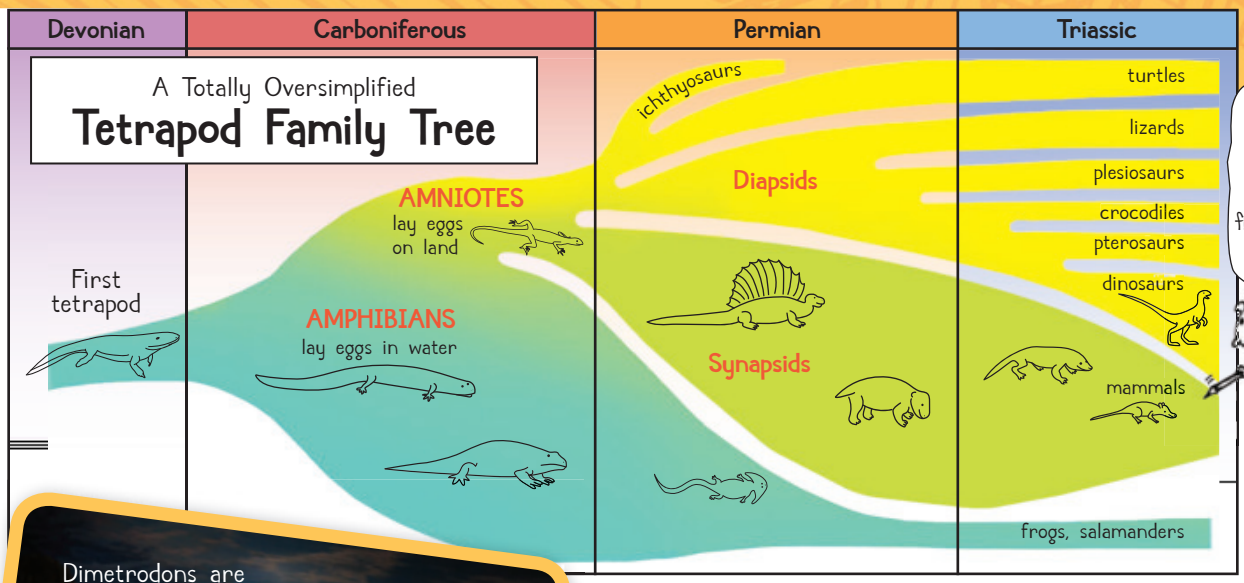
Do you have a pterodactyl? Or one of those Loch Ness Monster creatures called a plesiosaur? Or how about a dimetrodon, with its majestic sail rising from its back?

Well, guess what? Not one of these is actually a dinosaur.

What Makes an Animal a Dinosaur?

Dinosaurs are an ancient group of animals that first appeared about 240 million years ago. All dinosaurs share a common ancestor and are alike in some important ways. Members of the dinosaur family have bones, walk on land, and have hips that put their legs directly below their bodies, not splayed to the side like a lizard. Dinosaurs also had two holes in their skulls behind their eyes.

Plesiosaurs and pterodactyls lived at the same time as the dinosaurs. But their families split off from the dinosaurs early on. They are more like dinosaur cousins.



Sharp teeth reveal that they were meat eaters.

Plesiosaurs swam in the water, so they are not dinosaurs. Pterodactyls flew in the air. They are not dinosaurs either. But what about dimetrodons? They look like small dinosaurs with sails on their backs. They have bones and four limbs, breathe air, and live on land. But other clues reveal that dimetrodons belong to a completely different group of ancient animals.

The first clue is their age. Dimetrodons lived long before the dinosaurs. They roamed 290 to 270 million years ago, during the Permian era. The last dimetrodon had been extinct for 30 million years before the first scrappy dinosaur even appeared on Earth.

Another clue that dimetrodons are not dinosaurs is in their legs and hips. Dimetrodon legs stuck out from the sides of their bodies, so they waddled like lizards. They didn't walk like dinosaurs.

Dimetrodon skulls are also different. They have just one large hole behind each of the eye sockets. (This hole let muscles through to connect to the jaw.)

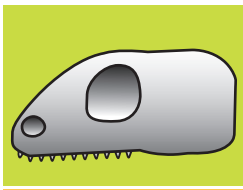
That single skull hole tells us that dimetrodons belong to a group of animals called synapsids.

How many holes are in your skull? Surprisingly, this is one big clue to what family of animals you belong to.

Are You a Dinosaur?

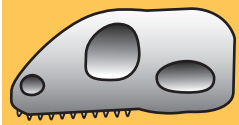
Do you...?	 T. Rex	 Pterodactyl	 Dimetrodon	 Elephant	 Clam
Have bones?	✓	✓	✓	✓	✗
Walk on land?	✓	✗	✓	✓	✗
Have legs under your body, not out to the sides?	✓	✗	✗	✓	✗
Have two skull holes behind each eye?	✓	✓	✗	✗	✗

If you answer "NO" to any of these, then you are not a dinosaur!



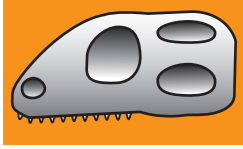
Anapsids
No hole

turtles



Synapsids
One hole

dimetrodons and all modern mammals



Diapsids
Two holes

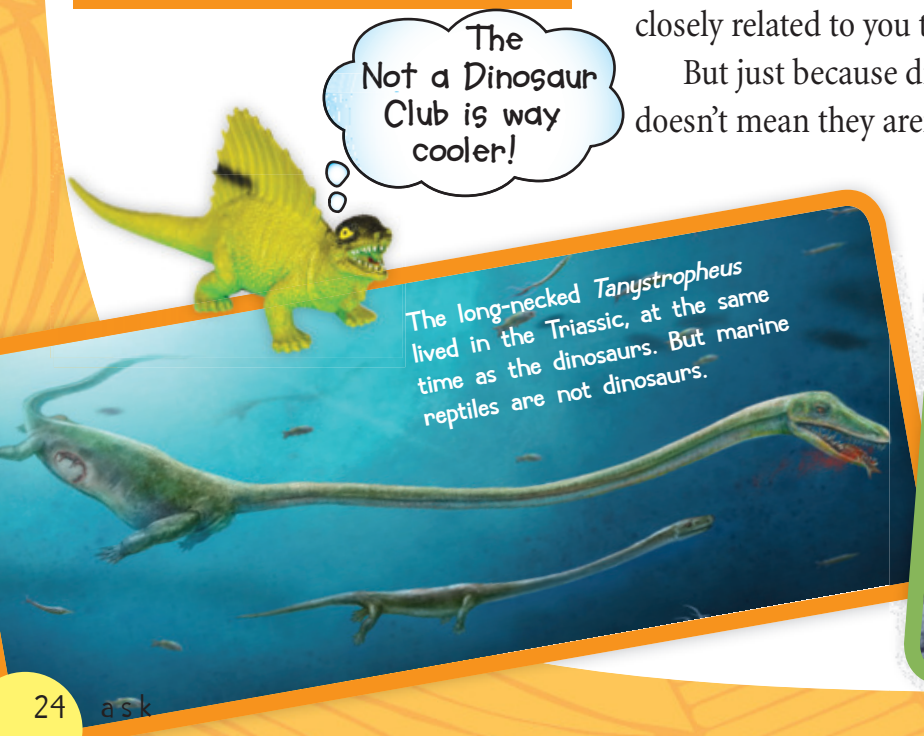
dinosaurs and most modern reptiles

Are You a Synapsid?

Early on, land animals with bones divided into three main branches. One branch, the diapsids, had two skull holes behind the eyes. Another branch, the synapsids, had just one skull hole. And a few had no skull holes—the anapsids.

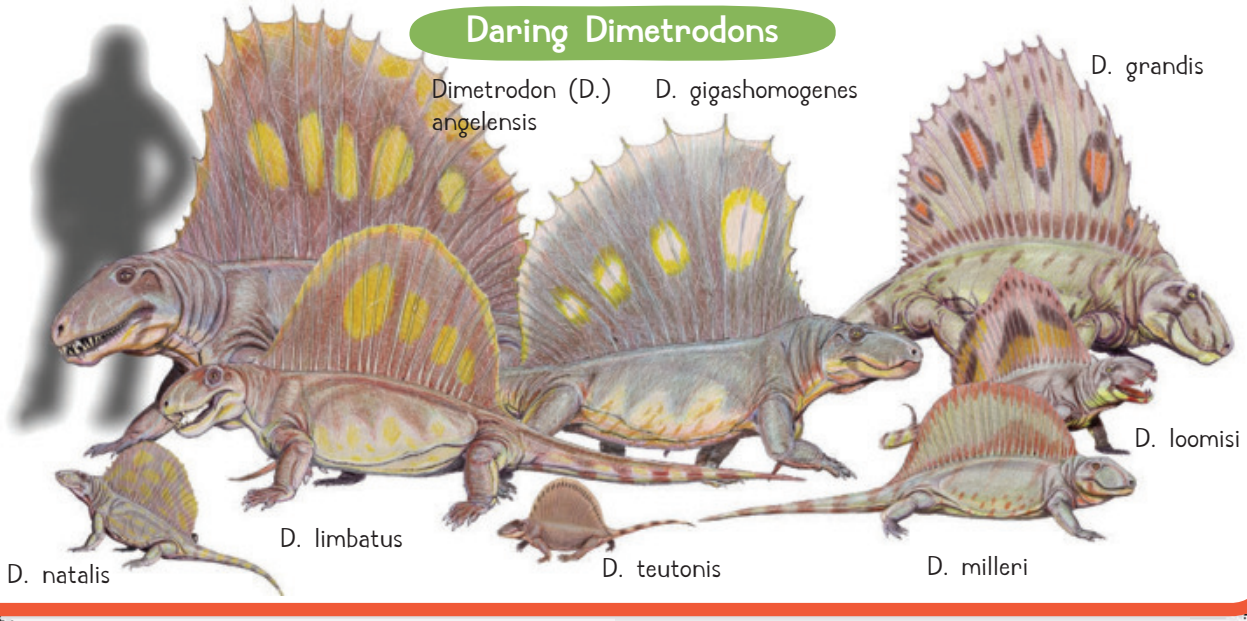
The two-hole diapsids evolved into dinosaurs, reptiles, and birds. One-hole synapsids evolved into dimetrodons and their cousins. One branch of the synapsid family eventually evolved into mammals—including us. Which means that dimetrodons are more closely related to you than to dinosaurs!

But just because dimetrodons aren't dinosaurs doesn't mean they aren't very cool and interesting.



The Triassic *Henodus* looks like a turtle, but it's actually a placodont, an extinct family of marine reptiles.

Daring Dimetrodons



Meet the Sailbacks

So if they weren't dinosaurs, who were the dimetrodons?

There were many species of dimetrodons, small and large. The largest were about the size of a car. From their pointy teeth and strong jaws, we can tell that they were carnivores. Scientists believe that they were the top land predators of their time.

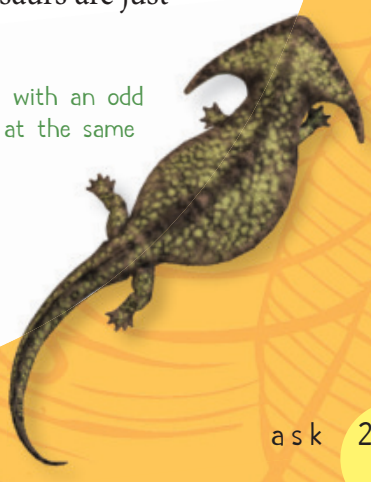
A dimetrodon's most noticeable feature is the big sail on its back. This sail was made of bony rods, with skin in between. All dimetrodons had them. What were the sails for? We don't know for sure, but scientists think that they were used to control body temperature and to attract mates.

Dimetrodon fossils have been found in the United States and in Europe. Back in the Permian era, these countries were all connected as part of a single supercontinent. Dimetrodons lived in tropical forest swamps alongside giant horsetail plants and other odd-looking animals.

What's in a Name?

So why do prehistoric animals that aren't dinosaurs show up in dinosaur books, movies, and bags of plastic dinosaurs? The answer in part is that they look alike at first glance. And they are so interesting that people want to share them. It's too bad there isn't a catchy word like *dinosaur* that includes all prehistoric vertebrates. But whatever we call them, the prehistoric world is full of fascinating creatures. Dinosaurs are just the beginning.

Mammals descend from therapsids, one branch of the synapsid family. They were cousins of dimetrodons.



Diplocaulus, an amphibian with an odd shovel-shaped head, lived at the same time as the dimetrodons.

by A. Roach, art by Laura Fisk

The Secret of My Success

Hello! Wait! Don't run away. Yes, I know I am a cockroach. SO, what's wrong with that?

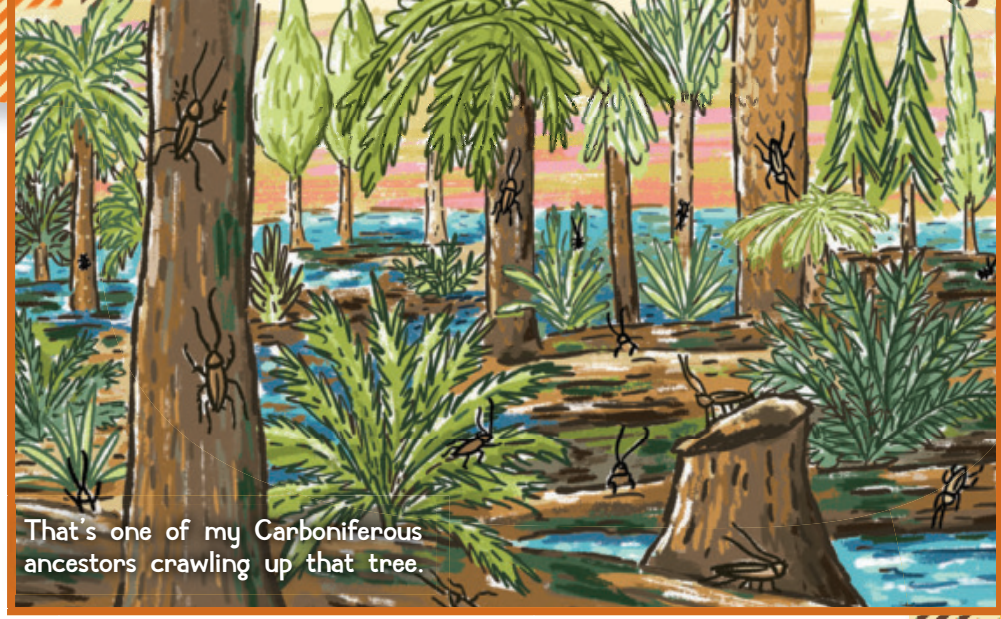
You are speaking to the most successful species on the planet, you know! We've been around for 350 million years! Survived five mass extinctions! Dinosaurs, gone. Trilobites, gone. Dodos, gone.

But WE'RE STILL HERE.

So what's the secret of our success? Be small! Run fast! Eat anything! Lay lots of eggs! Let me show you how it's done.

It all started a long, long time ago. The venerable family of Roach has been crawling around since at least the Devonian.

By the Carboniferous era, half the insects on earth were roaches! Some people call the Carboniferous the Age

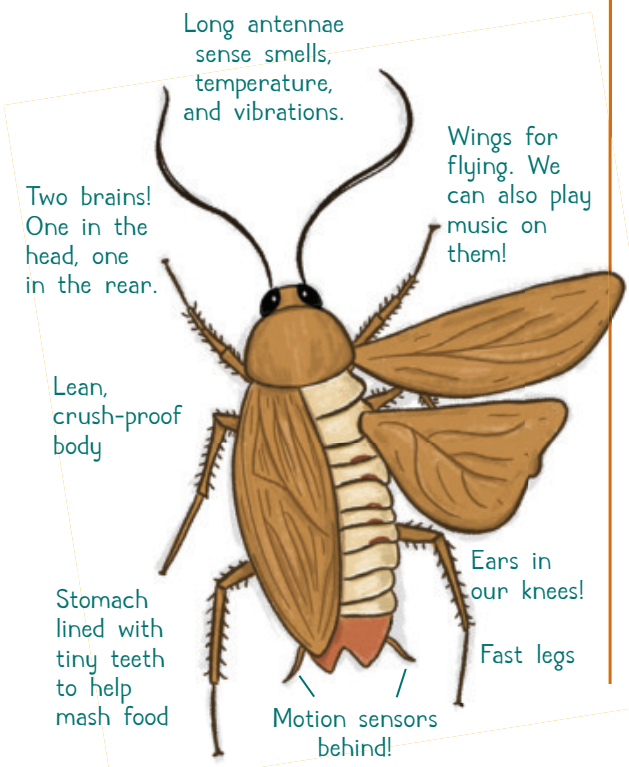


of Coal, but around here it's known as the Age of Roaches.

Sure, we've had plenty of enemies. If you're small and full of protein, everything wants to eat you. Fish! Amphibians! Reptiles! Mammals! And don't even talk to me about birds.

So what did we do? We got quick, is what. We learned to hide, is what. Today's lean, mean, turbo roach can squeeze so flat, we can fit through a slot no bigger than a dime. And we're virtually uncrushable! Really! I dare you, try it.

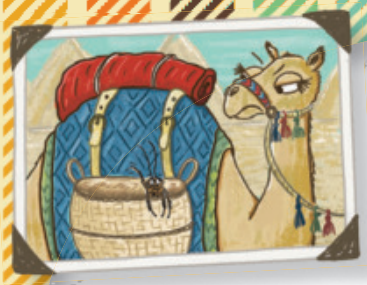
Over the last 350 million years, we've had plenty of time to perfect our amazing design.



And we never pass up a meal! What do we eat? What have you got? Rotting leaves, garbage, glue, paper, leather, insulation, corks, poop…and if you like to eat dead things and poop, I tell you, the world is your refrigerator! Just don't offer me a cucumber. Blech.

We've had to share the earth with all kinds of weird-looking creatures. None as weird as you, though. I mean, where's your exoskeleton? Where are your scales, your stingers, your beaks? Honestly, I don't know how you manage. But however odd the animals look, they all leave little packages of food around, just for us.

Ice ages came and went. Dinosaurs went extinct. Then the mammoths. But roaches, we just kept going.



Once humans came along, roaches went everywhere humans went. In ships, on planes, in camel packs across the desert. Roach road trip!

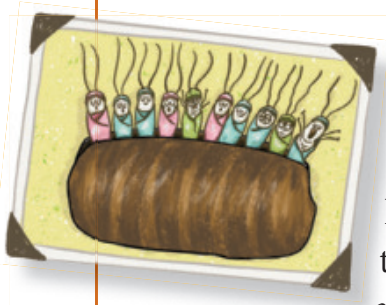
We even tagged along to space! That's Uncle Anton. He hid on board the Apollo XII capsule—he was so mad when they just came right back to earth.

You can't have too many roaches, I say. Now there are 4,000 species of us: Asian, American, German, smokybrown, Madagascar hissing cockroaches…I hope you get to meet them all someday.

Some of the family get pretty odd. That's Reginald. He thinks if he pretends to be a firefly, birds won't eat him. Shh, just play along.

That's tough old Aunt Flo. She worked for some scientists trying to figure out ways to get rid of us…ha! Poison, radiation, heat, cold…whatever they throw at us, we just get tougher. Bring it on!

Aw, look, that's me just after my 15 brothers and sisters and I hatched from our egg case. Yeah, I look pretty much the same. That's another roach innovation—we skip the larva stage. Our eggs hatch all ready to roll! Still pretty cute, though.



My first pizza!

First bath scare!

Missed again! Yep, that's how we got to be the most successful species on the planet.

Ask Ask

WITH SAGE AND BRIAR

?!?!?

TEXT BY ellen R. braaf
ART BY MARNIE GALLOWAY

Hey, Sage! Murdock Elementary School wants to know, who invented shoes?

No one knows. It's a history mystery! The oldest shoe ever found is about 9,000 years old. But some scientists who study toes believe that humans started wearing shoes 30,000 to 40,000 years ago.

Toes?!?

Early humans who went barefoot used their toes to grip the ground. They grew thicker toe bones.

When people started wearing shoes, toes didn't have to work so hard. So they have thinner toes.

So what did the first shoes look like?

They were probably sandals made from woven grass or moccasins made from animal skins.

In winter, I stuff my deer-hide shoes with dry grass for warmth.

Who made the shoes?

Until modern times, shoes were made by hand to fit each person. Many people made their own shoes. Professional shoemakers sewed shoes around a wooden foot shape called a "last." They kept a set of different sizes.

Shoes are such a funny shape—can a machine even sew one?

Many inventors worked on the problem. In 1883, Jan Matzeliger invented a machine that could shape shoes and stitch tops to bottoms. With that, factories could turn out hundreds of shoes a day.

Shoes got cheaper, and more people bought them.

And they could make more different kinds.

I'm grateful to the inventor who invented these!

Only the most recent in a long history of flashy footwear.

ASK US ANYTHING!

WRITE TO US AT:
ASK
70 EAST LAKE STREET
SUITE 800
CHICAGO, IL 60601

OR HAVE YOUR PARENT EMAIL
ASK@CRICKETMEDIA.COM

CONTEST and LETTERS

Send your letters to Ask Mail, *70 East Lake St., Suite 800, Chicago, IL 60601, or have your parent/legal guardian email us at ask@cricketmedia.com.*

In our November/December issue we asked you what you might pack for the long trip to Saturn. Thanks to all you amply amused astronauts for sharing your suitcases!

Saturn Suitcase
Cason P., age 9, Washington

My Saturn-bound Suitcase
Ed M., age 8, Maine

Emily S., age 9, Texas

Angela Z., age 6, California

Dear *Ask*,
I was wondering what life was like 1 billion years ago. Could you make a magazine about that? I know one thing, life would be SO different. I have had that question on my mind for two years.

Sincerely,
Annabelle C.,
Indiana

Dear Annabelle,
A billion years is a really long time—that's a thousand million years. Two years is also a long time to have a burning question! I'm glad we're finally getting around to it. A billion years ago was way before dinosaurs, or any animals, or even plants—that long ago, cells were just starting to bunch together to make simple, tiny organisms. So maybe we'll start just half a billion years ago, when things got more interesting. I hope you enjoy this month's magazine! Keep pondering those pesky questions!

Regards,
Editor Plush

The Biggest Suitcase Ever!!
Harper S.,
age 9, France

Space Suitcase Arrangement
Ksenia P.,
age 9,
New Jersey

Peter O.,
age 10

My Carry-Ons
Sadie S., age 11,
France

If I went to Saturn
I would pack a really heavy jacket, enough candy, water, and books for 17 years, a net to catch diamonds, and an asteroid blaster.
My suit would have jets to blow against the wind, and oxygen, and a camera.
Satyaki S., age 8, California

Preparo Suitcase
Violet B., age 7, Massachusetts

Dear Bone Pony,
How do you eat hay if you are only bones?
Lorelei S., age 8,
Arizona

Dear Lorelei,
Very carefully.
Bone Pony

Dear Marvin,
I know a good prank you can play on Plush! Draw with some red pen on your skin. Then fall and pretend to cut yourself. Plush will think you really did! She might even give you a bandage!
Good luck!
Theresa G., age 9
Michigan

Dear Theresa,
It works even better if when you're pretending to fall, you slip and cut your hand on a rock for real. Super convincing! Plush was totally fooled! Next time I'm going to put ketchup and spaghetti under my shirt and tell her my guts exploded.
Prank on!
Marvin the Daredevil

April Contest

Prehistoric Pals

Why do dinosaurs get all the attention? Time to change that! For this month's contest, make an ad, poster, or playing card to tell the world about the wonders of your favorite prehistoric creature that's not a dino. Dreaming of dimetrodons? Excited by eryops? Cheering for Carboniferous cockroaches? Send us your shout-out, and we'll post a parade of the most persuasive in an upcoming issue of *Ask*.

Contest Rules:

1. Your contest entry must be your very own work. Ideas and words should not be copied.
2. Be sure to include your name, age, and address on your entry.
3. Only one entry per person, please.
4. If you want your work returned, enclose a self-addressed, stamped envelope.
5. Your entry must be signed or emailed by a parent or legal guardian, saying it's your own work and that no one helped you, and that *Ask* has permission to publish it in print and online.
6. For information on the Children's Online Privacy Protection Act, see the Privacy Policy page at cricketmedia.com.
7. Email scanned artwork to ask@cricketmedia.com, or mail to: *Ask*, 70 East Lake St., Suite 800, Chicago, IL 60601. Entries must be postmarked or emailed by April 30, 2020.
8. We will publish the winning entries in an upcoming issue of *Ask*.

Whatson's BOOK CORNER

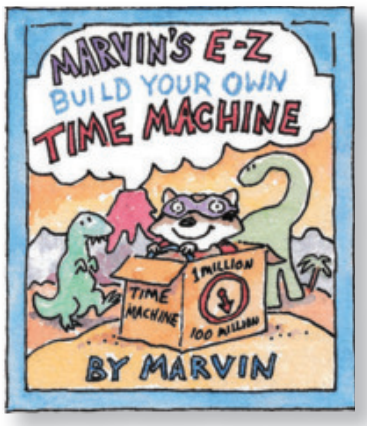
Ocean Renegades!

by Abby Howard

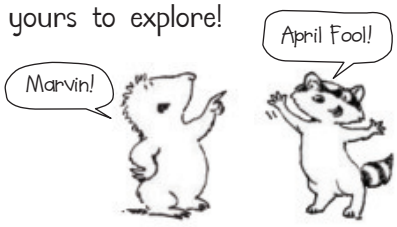
Hungry for even more ancient creatures? These fantastic cartoon books by one of our favorite science cartoonists takes you to meet all the amazing creatures that lived long ago, from the weird fish of the Cambrian, to giant salamanders, and the world's largest bugs. The epic story continues in two sequels, *Dinosaur Empire!* and *Mammal Takeover!*

E-Z Build Your Own Time Machine

by Marvin

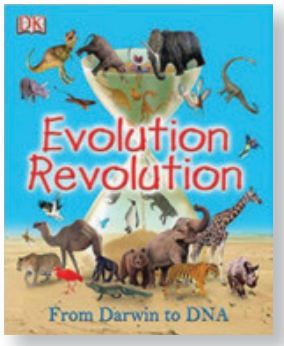


If you REALLY want to know what life was like in the Cambrian, go see! It's easy with Marvin's astounding, completely 100% working, build-it-yourself time machine! This Nobel prize-winning book tells you how. All you need is a cardboard box—and all of history is yours to explore!



Evolution Revolution

by Robert Winston



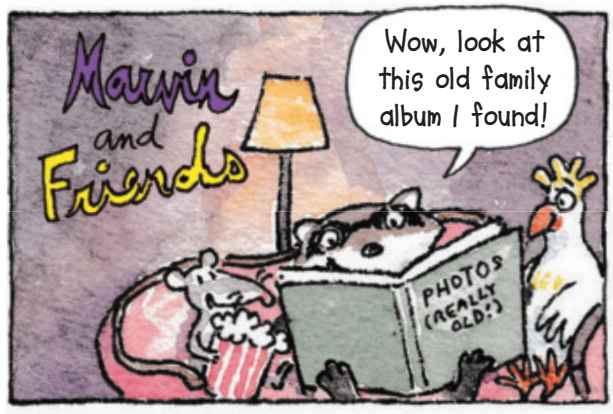
This book can tell you anything you ever wanted to know about evolution—what it is, how it works, what DNA does, where stripes came from, why dogs don't have kittens, and much more. Plus, see evolution in action, and find out how the elephant really got its trunk.

When Fish Got Feet, Sharks Got Teeth, and Bugs Began to Swarm

by Hannah Bonner

These amusing books with long titles start back when life first crawled up on land—back when the oceans were full of shelled squid and giant armored fish. Every page is covered in cartoony pictures that explore life in the ancient world, sometimes as newscasts by wise-cracking lizards. Set the dial for way back, weird, and swampy.

text and art by Thor Wickstrom



April 2020 Volume 19 Number 4 cricketmedia.com $6.95