

SCHOOL LAUNCH · EXPLORE TRACKS

EXPLORE TRACKS · TRAIL A

Three interest tracks for curious Scouts: Animals (mammals), Dinosaurs and Great Battles of the ancient world. Short, self-paced stops with true stories, great pictures, hands-on projects and games.

First edition

The works of the LORD are great, sought out of all them that have pleasure therein.

Psalm 111:2 (KJV)

COURSE GUIDE

Explore Tracks are for children who want more of what they love. Each track is a trail of short stops. At every stop the child hears a true story, studies a great picture, does something with his or her hands, plays a game and adds a page to a Field Notebook.

Trail A is the first trail of each track at the  Scout level (ages 7-9). The Animals track meets ten mammals. The Dinosaurs track meets ten famous dinosaurs and learns the museum words Triassic, Jurassic and Cretaceous, with a creation-friendly view of the dates on museum signs. The Great Battles track visits eight battles of the ancient world, from Marathon to Alesia, and ends with two victories God gave His people at Jericho and through Gideon.

WHO IT IS FOR

Written for children about ages 7-9 who are read to by a parent, or who read short passages on their own. Older siblings can join in. Nothing earlier is required.

HOW TO USE THIS COURSE

1. **One stop at a time.** A stop takes 15-25 minutes: read the story aloud, look at the picture, do the hands-on part and play the game. Two or three stops a week works well.
2. **Any order.** The tracks are independent. Do one track at a time, or rotate between them.
3. **Field Notebook.** Every stop ends with a page for the notebook. At the end of the trail the pages become a booklet, and the parent signs the Trail A certificate.
4. **Badge quizzes.** Each track has two short, optional oral quizzes. They are for fun, not grades.

SCOPE AND SEQUENCE

Track 2: Dinosaurs  **Trail A: Meet the Dinosaurs** (Self-paced)

MATERIALS

- **Field Notebook (a sketchbook or composition book)** One for the whole trail.
- **Colored pencils, a ruler, scissors and glue** For drawings and maps.
- **Household things** Each hands-on project lists what it needs: blocks, clay, string, toy figures, cups.
- **A Bible (KJV)** For the verse at each stop and the Jericho and Gideon stop.

GRADING

Explore Tracks are not graded. A stop is done when the child has heard the story, done the hands-on part and made a notebook page.

Badges and the Trail A certificate are earned by finishing the stops.

A NOTE TO PARENTS

You do not need to be an expert. Read the story aloud, look at the picture together and ask, “What do you notice?” Each stop has a short *For families* note with background and any facts that scholars still discuss.

Dinosaur dates: museums give ages in millions of years. This trail teaches the period names as museum vocabulary and explains that the dates are interpretations; many Christian families understand the fossils within a young earth and the Flood.

Battles are told for young children: who, where, the plan, what happened and why it mattered, with honor for courage and wisdom and no gory detail.

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Each stop takes 15–25 minutes. Tracks may be done in any order, and a child may do just one track.

DINOSAURS TRAIL A: MEET THE DINOSAURS

The first trail of the Dinosaurs track meets ten famous dinosaurs, from *Tyrannosaurus rex* to *Argentinosaurus*, one of the biggest. Each stop tells what the bones show, how the dinosaur got its name and who found it, with a picture, something to make, quick questions, a game and Scripture.

This is the  **Scout** level, for ages 7 to 9. The track is creation-friendly: God made the land animals, dinosaurs among them, on the sixth day (Genesis 1:24–25). The period names museums use, **Triassic**, **Jurassic** and **Cretaceous**, are taught as vocabulary in a “Museum word” box, so a child can read any museum sign and know what it is claiming. Dates on signs are called what they are: interpretations.

Five stops earn the **Dinosaur Scout badge, part 1**; ten earn part 2 and the **Trail A certificate**.

BEFORE YOU BEGIN

- Listen to a short story and tell it back.
- Measure with a ruler or a tape measure (a grown-up may help).
- Know the six days of creation from Genesis 1, or read them together first.

MASTERY CHECKLIST

- ☐ I can name ten dinosaurs and tell one true thing about each.
- ☐ I can say what the name of a dinosaur means for at least five of them.
- ☐ I can tell a plant-eater from a meat-eater by its teeth.
- ☐ I can read the words Triassic, Jurassic and Cretaceous on a museum sign and say what they name.
- ☐ I can say what Genesis tells us about when God made the land animals.

OPTIONAL BOOKS AND RESOURCES

- **Field Museum (Chicago): SUE the T. rex** (<https://www.fieldmuseum.org>): Photos and facts about the most complete T. rex skeleton; a good “virtual visit.”
- **Smithsonian National Museum of Natural History** (<https://naturalhistory.si.edu>): The Hall of Fossils; practice reading museum signs together.

2.1 TYRANNOSAURUS REX

OBJECTIVES

- Tell what the name Tyrannosaurus rex means.
- Describe T. rex's size, teeth and short arms.
- Read the word "Cretaceous" on a museum sign.

Warm-up. Hold up a banana. Some T. rex teeth, counting the part hidden in the jaw, were about as long as a banana, around 12 inches!

Video slot. Video coming. T. rex skeletons in museums: SUE at the Field Museum. Search the Field Museum, Smithsonian; for creation-friendly framing, Answers in Genesis / Creation Museum videos once vetted.

KEY TERMS

dinosaur

A kind of reptile that lived long ago and walked with its legs straight under its body. Dinosaurs are known today from their fossils.

fossil

The remains or traces of a living thing, such as a bone, a tooth or a footprint, preserved in rock.

skeleton

All the bones of a body together.

Cretaceous

The name museums give to the rock layers where T. rex and Triceratops are found (say "kreh-TAY-shus").

CORE IDEAS

The story. In 1902, a fossil hunter named Barnum Brown was digging in the badlands of Montana when he found huge bones sticking out of the rock. They belonged to a giant meat-eating dinosaur no one had ever seen. In 1905, the museum scientist Henry Fairfield Osborn gave it a mighty name: *Tyrannosaurus rex*, which means "tyrant lizard king." Most people just call it **T. rex**.

How big was it? A big T. rex was about 40 feet long from its nose to the tip of its tail, about as long as a school bus. Its hips were about 12 feet off the ground, higher than a basketball hoop. It may have weighed as much as an elephant, or even more. Its head alone was about 5 feet long.

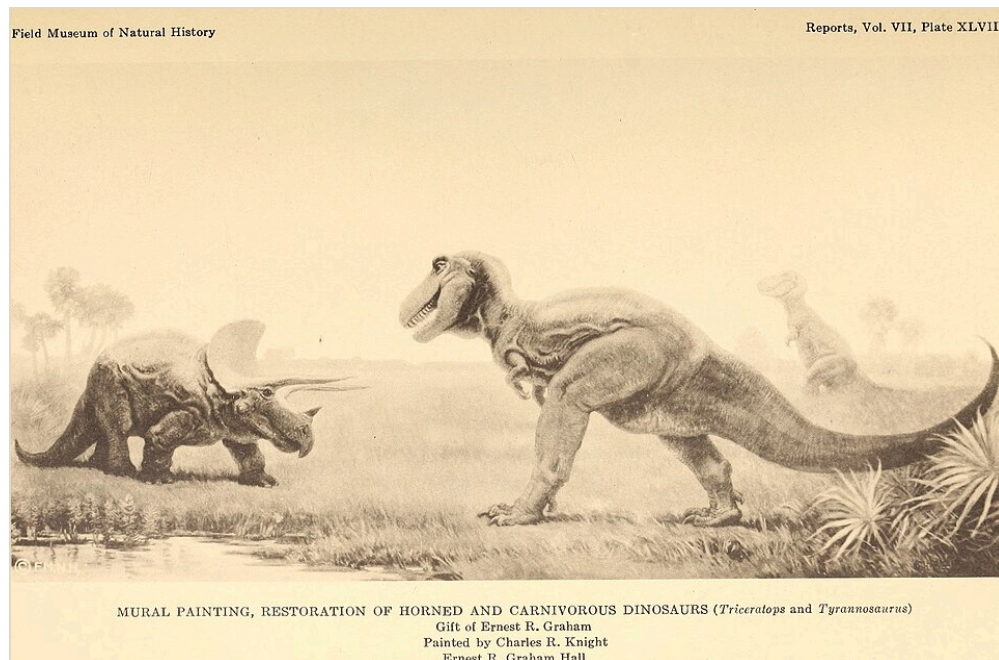
Teeth and jaws. T. rex had about 60 teeth, thick like bananas and jagged on the edges like a steak knife. Scientists think it had one of the strongest bites of any land animal ever. Its

teeth tell us it ate meat. When a tooth broke or fell out, a new one grew in its place.

Those little arms. T. rex had two very short arms, each about 3 feet long, with only two fingers. They look tiny next to its huge body, but they were thick and strong. Nobody knows for sure how T. rex used them. That is one of the mysteries the bones have not told us.

What the Bible tells us. Nobody saw T. rex being made except God. Genesis tells us that on the sixth day God made “the beast of the earth after his kind” (Genesis 1:25), and that means the dinosaurs too. When we look at the bones of T. rex, we are looking at the work of the Creator.

PICTURE STUDY



Tyrannosaurus and Triceratops (mural), Charles R. Knight, 1927 · Oil mural · Field Museum, Chicago
Wikimedia Commons · Public domain

Charles R. Knight was the most famous painter of dinosaurs in his day. He worked closely with scientists and visited the bones in museums before he painted. His big murals hung in the Field Museum in Chicago for many years and taught millions of children what dinosaurs might have looked like.

Look closely

- Find T. rex. How is it standing?
- Find the Triceratops. What are they doing?
- Look at the land and the sky. What kind of place is this?

Talk about it

1. Scientists today think T. rex held its tail out straight behind it, not dragging on the ground. Does Knight's T. rex hold its tail up or down?

2. Why do pictures of dinosaurs change as people find more bones?

HANDS-ON: A LIFE-SIZE T. REX IN CHALK

Find out how big T. rex really was by drawing it full size.

You will need

- A tape measure or a 10-foot string
- Sidewalk chalk
- A driveway, playground or quiet lot, and a grown-up

Steps

1. Mark a starting point for the tip of the nose. Measure 40 feet in a straight line for the tip of the tail.
2. From the nose, measure 5 feet; that is the head. Draw a big head shape there.
3. Draw the body and the long tail along the line, and two strong legs under the hips.
4. Draw two tiny arms, about 3 feet long, near the front of the chest.
5. Lie down along the T. rex. How many of you fit inside it?

Check your work

- My T. rex is 40 feet long.
- The head is about 5 feet long.
- I drew the short two-fingered arms.

FIELD NOTEBOOK

1. Draw a T. rex tooth life-size, about 12 inches long, and label it "T. rex tooth."
2. Write: "Tyrannosaurus rex means tyrant lizard king."

Did you know? The most complete T. rex ever found is named SUE. It was found in South Dakota in 1990 and now stands in the Field Museum in Chicago. T. rex fossils have been found in the western United States and Canada. T. rex had a very good sense of smell; the part of its brain for smelling was large.

Museum word. Museum signs say this dinosaur lived in the **Cretaceous**. That is a name scientists use for a group of rock layers and the fossils found in them. They often add a date such as "68 to 66 million years ago." That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago. The three big names on dinosaur signs are **Triassic**, **Jurassic** and **Cretaceous**, from the lowest rock layers to the highest. Learn them, read the sign, and then you know what it claims.

Goes deeper in. Life Science, Kindergarten, Lesson 7.3 “Fierce Meat-Eaters” and Earth Science, Grade 3, Lesson 6.2 “Sue the T. rex” (coming soon).

For families. Dinosaur names and sizes in this trail follow museum descriptions. Sizes are estimates from bones and vary a little between sources. The “Museum word” box teaches the period names as vocabulary and labels dates as interpretations, as in the Earth Science series.

PRACTICE

1. **EASY** What does Tyrannosaurus rex mean?
2. **EASY** Did T. rex eat plants or meat? How do we know?
3. **MEDIUM** What word do museums use for the rock layers where T. rex is found?

Make it a game • Tyrant King Says. Play like “Simon Says,” but the leader says “T. rex says...” and everyone must keep their arms tucked in like tiny T. rex arms the whole time.

Scripture. “And God said, Let the earth bring forth the living creature after his kind, cattle, and creeping thing, and beast of the earth after his kind: and it was so.” (Genesis 1:24, KJV)

On the sixth day God spoke, and the land animals were made. The biggest meat-eater and the smallest beetle came from His word.

Practice: answers

1. “Tyrant lizard king.”
2. Meat. Its teeth were sharp, thick and jagged like steak knives.
3. Cretaceous.

2.2 TRICERATOPS

OBJECTIVES

- Tell what the name Triceratops means.
- Describe its horns, frill and beak.
- Tell the story of the horns that were first mistaken for a bison's.

Warm-up. Make three horns with your fingers: one finger on your nose and two above your eyes. You are a “three-horned face,” which is what Triceratops means!

Video slot. Video coming. Triceratops skulls and skeletons; horns and frill. Search the Smithsonian (Hatcher the Triceratops), Field Museum; creation channels once vetted.

KEY TERMS

horn

A hard, pointed growth on an animal's head.

frill

The wide bony shield at the back of a Triceratops' head.

beak

A hard, toothless mouth edge, like a parrot's.

herbivore

An animal that eats only plants.

CORE IDEAS

The story. In 1887, a pair of huge pointed horns was found near Denver, Colorado. They were sent to a famous scientist named Othniel Charles Marsh. Marsh looked at them and decided they came from a giant kind of bison! But soon after, a fossil hunter named John Bell Hatcher dug up a whole skull in Wyoming, with the same horns on it. It was not a bison at all. It was a dinosaur with three horns on its face. Marsh named it *Triceratops*, which means “three-horned face.”

Horns and a frill. Triceratops had a short horn on its nose and two long horns above its eyes. The long horns could be about 3 feet long, as long as a baseball bat. Behind its head was a wide bony **frill**, like a big collar or shield. Its skull was one of the biggest of any land animal, about 7 feet long, longer than a tall man.

A beak for plants. Triceratops was a **herbivore**, a plant-eater. The front of its mouth was a hard **beak**, like a giant parrot's, for snipping tough plants. Behind the beak were rows of teeth that sliced plants like scissors. When teeth wore out, new ones grew in to take their place.

Big and heavy. A grown Triceratops was about 26 to 30 feet long and as heavy as an elephant or more. It walked on four strong legs. Triceratops bones are found in the same rock layers as T. rex, and some Triceratops bones even have T. rex tooth marks on them.

Made by God. Why three horns and a frill? Scientists still wonder. The horns may have helped Triceratops defend itself, and the frill may have helped Triceratops know its own kind. However it used them, God designed Triceratops with care.

PICTURE STUDY



Triceratops, Charles R. Knight, 1901 · Watercolor · American Museum of Natural History, New York
Wikimedia Commons · Public domain

Charles R. Knight painted this Triceratops in 1901, early in his long career. He studied the skulls in museums so that he could paint the head correctly.

Look closely

- Count the horns. Where is each one?
- Find the frill. What does it look like to you?
- Look at the legs. How does Knight show that the animal is heavy?

Talk about it

1. What colors did Knight choose for Triceratops? Do we really know what color dinosaurs were?
2. If you met a Triceratops, would you feel safe or scared?

HANDS-ON: TRICERATOPS FRILL MASK

Make a Triceratops mask with three horns and a frill.

You will need

- A paper plate
- Construction paper
- Scissors (with a grown-up), glue or tape
- Crayons or paint
- Yarn or a craft stick

Steps

1. Cut a wide half-circle from the paper plate edge. This is the frill. Decorate its edge with bumps.
2. Roll three paper cones for horns: one short for the nose and two long for over the eyes. Tape them on.
3. Cut eye holes (a grown-up helps) and add a beak at the bottom.
4. Tie on yarn or tape on a craft stick to hold the mask.

Check your work

- My mask has three horns.
- It has a frill and a beak.

FIELD NOTEBOOK

1. Draw a Triceratops skull from the side. Label the nose horn, brow horns, frill and beak.
2. Write: "Triceratops means three-horned face."

Did you know? Triceratops is the state fossil of South Dakota and the state dinosaur of Wyoming. Baby Triceratops had short, stubby horns that grew and curved as they got older. A famous Triceratops skeleton at the Smithsonian is nicknamed "Hatcher," after the fossil hunter John Bell Hatcher, who found many Triceratops bones.

Museum word. Museum signs say this dinosaur lived in the **Cretaceous**. That is a name scientists use for a group of rock layers and the fossils found in them. Many signs give a date such as "68 to 66 million years ago." That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago.

Goes deeper in. Life Science, Grade 2, Lesson 7.3 "Horned dinosaurs" (coming soon).

For families. Marsh's 1887 "bison" (*Bison alticornis*) and his 1889 naming of *Triceratops* are well documented; the story is a gentle way to show that scientists revise their ideas when better evidence comes.

PRACTICE

1. **EASY** What does Triceratops mean?
2. **MEDIUM** What did Othniel Marsh first think the Triceratops horns came from?
3. **EASY** Was Triceratops a plant-eater or a meat-eater?

Make it a game • Horn Ring Toss. Stand a paper-towel tube “horn” in a lump of clay. Toss canning-jar rings or paper rings onto the horn from a few steps away.

Scripture. “Where wast thou when I laid the foundations of the earth? declare, if thou hast understanding.” (Job 38:4, KJV)

God asked Job this question to remind him that God alone was there at the beginning. Scientists like Marsh can make mistakes, but God knows all His works.

Practice: answers

1. “Three-horned face.”
2. A giant kind of bison.
3. A plant-eater (herbivore).

2.3 STEGOSAURUS

OBJECTIVES

- Tell what Stegosaurus means and why it got that name.
- Describe its plates and tail spikes.
- Read the word “Jurassic” on a museum sign.

Warm-up. Lay some playing cards or paper squares on your back, like roof shingles. Now stand them up in a row along your back. Which way do you think Stegosaurus’s plates went?

Video slot. Video coming. Stegosaurus plates and tail spikes. Search the Smithsonian, Denver Museum of Nature & Science, Dinosaur National Monument (NPS).

KEY TERMS

plate

A large, flat, bony piece. Stegosaurus had two rows of tall plates along its back.

spike

A long, sharp, pointed bone. Stegosaurus had four on its tail.

Jurassic

The name museums give to the rock layers where Stegosaurus is found (say “joo-RASS-ick”).

thagomizer

A nickname for the spiky end of a Stegosaurus tail.

CORE IDEAS

The story. In 1877, workers digging for Othniel Marsh in Colorado sent him some strange bones: big, flat, bony plates. Marsh thought the plates lay flat on the animal’s back, like the shingles on a roof. So he named it *Stegosaurus*, which means “roof lizard.” Later, more complete skeletons showed that the plates did not lie flat at all. They stood up in two rows along the dinosaur’s back!

Plates and spikes. A Stegosaurus had about 17 tall plates along its neck, back and tail, set in two staggered rows. The biggest were about 2 feet tall. At the end of its tail were four sharp **spikes**, each 2 or 3 feet long. A Stegosaurus could swing its tail to defend itself. Some fossils of meat-eating dinosaurs even have holes in their bones that fit a Stegosaurus spike.

A tail with a funny name. The spiky tail end has a funny nickname: the **thagomizer**. It comes from a cartoon drawn in 1982 by Gary Larson. In the cartoon, a cave man teacher points to a Stegosaurus tail and calls it a “thagomizer.” Scientists thought the name was so fun that they started using it too!

A plant-eater. Stegosaurus was about 30 feet long and as heavy as a big rhinoceros or more. Its head was small and low to the ground, and it ate low plants. Its back legs were longer than its front legs, so its back was high and its head was low.

A state fossil. Many Stegosaurus bones have been found in Colorado, Wyoming and Utah. In 1982, Colorado made Stegosaurus its state fossil, after schoolchildren asked for it!

PICTURE STUDY



Stegosaurus, Charles R. Knight, 1901 · Watercolor · American Museum of Natural History, New York
Wikimedia Commons · Public domain

Charles R. Knight painted Stegosaurus many times. In 1901 he showed it with its plates standing up, following the newer skeletons and the scientists' ideas of his day.

Look closely

- Find the plates. Are they standing up or lying flat?
- Count the tail spikes.
- Look at the head. Is it big or small compared to the body?

Talk about it

1. If Marsh had been right about the plates lying flat, how would this painting look different?
2. What would you name Stegosaurus, if you could choose?

HANDS-ON: CLAY STEGOSAURUS

Build a small Stegosaurus with plates that stand up in two rows.

You will need

- Modeling clay or salt dough
- Pumpkin seeds, cardboard triangles or crackers for plates
- Four toothpicks (with a grown-up)

Steps

1. Roll a fat body with a long tail and a small head. Add four legs, making the back legs longer than the front legs.
2. Press plates into the back in two rows. Stagger them, so they take turns side to side.
3. Push four toothpick halves into the end of the tail for the thagomizer.
4. Let it dry and give it a name.

Check your work

- My Stegosaurus has two rows of plates.
- It has four tail spikes.
- Its back legs are longer than its front legs.

FIELD NOTEBOOK

1. Draw a Stegosaurus. Label the plates, the spikes (thagomizer) and the small head.
2. Write: “Stegosaurus means roof lizard.”

Did you know? Scientists still argue about what the plates were for. Some think they helped Stegosaurus warm up or cool down; some think they helped others of its kind recognize it. The plates were not solid; they had many small channels in them for blood vessels. Stegosaurus had a small head for such a big body.

Museum word. Museum signs say this dinosaur lived in the **Jurassic**. That is a name scientists use for a group of rock layers and the fossils found in them. Signs often give a date such as “about 150 million years ago.” That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago. Notice that the sign calls Stegosaurus older than T. rex, because its bones are found in lower rock layers.

Goes deeper in. Life Science, Grade 1, Lesson 7.1 “Stegosaurus plates” and Grade 2, Lesson 7.2 “Armored dinosaurs” (coming soon).

For families. The “thagomizer” is a real paleontology nickname that began with Gary Larson’s 1982 *Far Side* cartoon. Colorado named Stegosaurus its state fossil in 1982 after a campaign by elementary students.

PRACTICE

1. **EASY** What does Stegosaurus mean?
2. **MEDIUM** Why did Marsh give it that name?
3. **EASY** What word do museums use for the rock layers where Stegosaurus is found?

Make it a game • Thagomizer Tag. Tuck a scarf in your back pocket as your “thagomizer.” Players try to grab each other’s scarves. If yours is taken, you help guard a teammate.

Scripture. “O LORD, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches.” (Psalm 104:24, KJV)

God made many different creatures, each with its own design: plates, spikes and all.

Practice: answers

1. “Roof lizard.”
2. He thought the plates lay flat on its back like the shingles on a roof.
3. Jurassic.

2.4 BRACHIOSAURUS

OBJECTIVES

- Tell what Brachiosaurus means and why.
- Describe how tall and long it was, compared with things we know.
- Tell why scientists no longer think it lived in lakes.

Warm-up. Stand under a tall tree or the side of a two-story house and look up. A Brachiosaurus could hold its head about 40 feet high, as high as a four-story building!

Video slot. Video coming. Sauropods: Brachiosaurus and Giraffatitan skeletons, the long neck. Search the Field Museum, Museum für Naturkunde Berlin, Smithsonian.

KEY TERMS

sauropod

A huge plant-eating dinosaur with a long neck, a long tail and four thick legs.

vertebra

One of the bones of the backbone (plural: vertebrae).

Jurassic

The museum name for the rock layers where Brachiosaurus is found.

Behemoth

A huge, strong animal God describes in Job 40.

CORE IDEAS

The story. In the summer of 1900, a scientist named Elmer Riggs from the Field Museum in Chicago was digging near Grand Junction, Colorado. He found giant bones: part of a backbone, ribs, and a thigh bone almost 7 feet long. In 1903 he named the animal *Brachiosaurus*, which means “arm lizard,” because its front legs were longer than its back legs, like a giraffe’s.

A living tower. Brachiosaurus was a **sauropod**, one of the long-necked giants. Because its front legs were long, its back sloped up toward its shoulders, and its long neck could lift its head about 40 feet high. From nose to tail it was about 85 feet long, longer than two school buses. It weighed as much as several elephants put together.

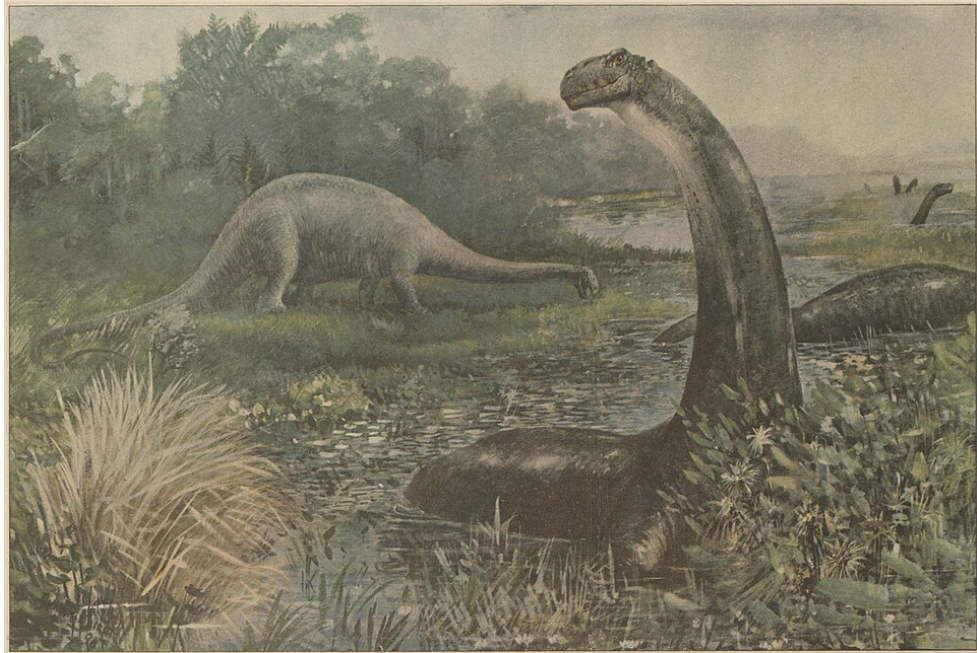
A treetop eater. With its head held high, Brachiosaurus could reach leaves at the tops of tall trees, where other animals could not reach. It had chisel-shaped teeth for stripping leaves from branches. It must have eaten a mountain of plants every day.

A wrong idea fixed. Brachiosaurus had bony nose openings high up on its head. Long ago, some scientists thought this meant it lived in deep lakes, with only the top of its head poking

out to breathe, and that its huge body needed water to hold it up. Later scientists studied its strong legs and narrow feet and saw that it was built to walk on land. It probably did not live in the water at all.

Behemoth. In the book of Job, God describes a mighty animal called Behemoth: “he moveth his tail like a cedar” (Job 40:17). Many Christians think Behemoth may have been a great sauropod like Brachiosaurus. Whatever Behemoth was, God says, “Behold now behemoth, which I made with thee.”

PICTURE STUDY



Brontosaurus, Charles R. Knight, 1897 · Watercolor · American Museum of Natural History, New York
Wikimedia Commons · Public domain

Charles R. Knight painted this picture of long-necked sauropods in 1897. In those days scientists thought these giants spent much of their time in swamps and lakes, and Knight painted what they believed.

Look closely

- Find the long necks. How many sauropods can you see?
- Where are they standing: on land, or in the water?
- Look at the plants. What kind of place is this?

Talk about it

1. Scientists now think sauropods lived on land. How would you change this painting to show that?
2. Why is it good for scientists to change their minds when they find better evidence?

HANDS-ON: HOW TALL IS FORTY FEET?

Find something near your home that is about as tall as a Brachiosaurus could reach.

You will need

- A long string or rope, 40 feet
- A tape measure
- A grown-up

Steps

1. Measure 40 feet of string with the tape measure.
2. Lay it on the ground from the bottom of a tree, a house or a flagpole, out across the yard. That is how high the head of a Brachiosaurus could reach.
3. A house is about 10 feet per story. How many stories tall is 40 feet?
4. Now measure out 85 feet, the whole length of Brachiosaurus. Walk it!

Check your work

- I measured 40 feet and 85 feet.
- I found that 40 feet is about 4 stories of a building.

FIELD NOTEBOOK

1. Draw Brachiosaurus next to a giraffe and a house, to show how tall it was.
2. Write: “Brachiosaurus means arm lizard, because its front legs were longer than its back legs.”

Did you know? A close cousin found in Tanzania in Africa, now called Giraffatitan, stands in a museum in Berlin, Germany. It is one of the tallest dinosaur skeletons on display anywhere. Some of a sauropod’s bones were full of air spaces, which made its long neck lighter. A life-size cast of Riggs’s Brachiosaurus first stood in the Field Museum in Chicago in 1993. Today it stands in Terminal 1 of O’Hare Airport in Chicago, where travelers walk right under it!

Museum word. Museum signs say this dinosaur lived in the **Jurassic**. That is a name scientists use for a group of rock layers and the fossils found in them. Signs often give a date such as “about 154 to 150 million years ago.” That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago.

Goes deeper in. Life Science, Grade 1, Lesson 7.2 “Long necks” and Grade 6, Lesson 7.2 “Sauropod necks and hearts” (coming soon).

For families. The identity of Behemoth is presented as a view many Christians hold, not

as settled fact. Trail D (Dinosaurs and the Bible), Stop D2, looks at Job 40 closely.

PRACTICE

1. **EASY** What does Brachiosaurus mean?
2. **MEDIUM** Why did it get that name?
3. **MEDIUM** Why do scientists no longer think Brachiosaurus lived in lakes?

Make it a game • Treetop Reach. Hang paper “leaves” at different heights. Players stretch tall like a Brachiosaurus to pick the highest leaf they can reach without jumping.

Scripture. “Behold now behemoth, which I made with thee; he eateth grass as an ox.” (Job 40:15, KJV)

God made Behemoth, the mightiest of land animals, and He made it to eat plants. Many Christians think Behemoth may have been a sauropod.

Practice: answers

1. “Arm lizard.”
2. Its front legs (arms) were longer than its back legs.
3. Its strong legs and narrow feet were built for walking on land.

2.5 VELOCIRAPTOR, THE REAL SIZE

OBJECTIVES

- Tell how big a real Velociraptor was.
- Describe its sickle claw and its feathers.
- Tell where and when Velociraptor was first found.

Warm-up. Picture a turkey on a farm. Would you be scared of it? A real Velociraptor was about the size of a turkey, with a long tail!

Video slot. Video coming. Velociraptor fossils and the Fighting Dinosaurs fossil from Mongolia. Search the American Museum of Natural History, Smithsonian.

KEY TERMS

raptor

A word that means a robber or seizer; also a name for hunting birds like hawks.

sickle claw

A large curved claw on the second toe of each foot of Velociraptor.

quill knobs

Little bumps on a bone where big feathers were attached.

Gobi Desert

A huge desert in Mongolia and China where many dinosaur fossils are found.

CORE IDEAS

The story. In 1923, a team of explorers led by Roy Chapman Andrews of the American Museum of Natural History drove across the Gobi Desert of Mongolia. At a place of glowing orange rocks called the Flaming Cliffs, a member of the team, Peter Kaisen, found a small skull and a curved claw. In 1924, Henry Fairfield Osborn named the animal *Velociraptor*, which means “swift seizer.”

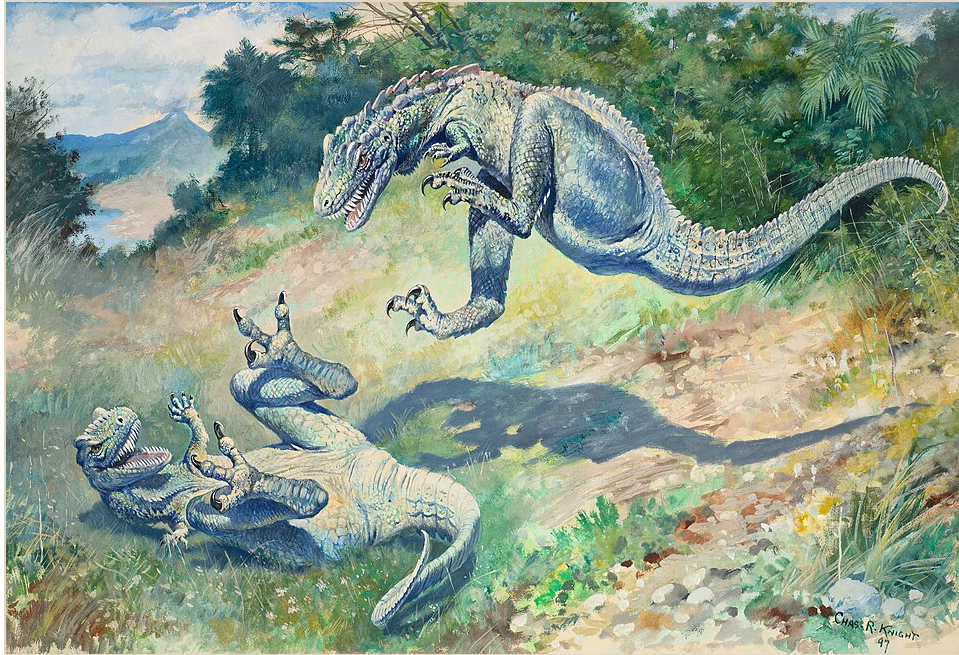
Smaller than the movies. In movies, Velociraptor is often shown as tall as a man. But the real Velociraptor was about the size of a turkey! It was about 6½ feet long, mostly tail, and stood about a foot and a half tall at the hips. It weighed about 30 to 35 pounds, about as much as a medium-sized dog. The big “raptors” in movies are really more like its larger cousins.

The sickle claw. On the second toe of each foot, Velociraptor had a big curved claw, shaped like a farmer’s sickle. It held this claw up off the ground as it walked, so it stayed sharp. It also had sharp teeth and long arms with three clawed fingers.

Feathers! In 2007, scientists looked closely at a Velociraptor arm bone and found a row of little bumps called **quill knobs**. On birds, quill knobs are where big wing feathers attach. This shows that Velociraptor had feathers on its arms. It could not fly, but it was a feathered dinosaur.

The Fighting Dinosaurs. In 1971, explorers in the Gobi found one of the most famous fossils ever: a Velociraptor and a Protoceratops locked together, buried suddenly by sand in the middle of a fight. Neither one ever got away.

PICTURE STUDY



Leaping Laelaps, Charles R. Knight, 1897 · Watercolor · American Museum of Natural History, New York
Wikimedia Commons · Public domain

Charles R. Knight painted *Leaping Laelaps* in 1897. It shows two meat-eating dinosaurs now called *Dryptosaurus*. At a time when most people pictured dinosaurs as slow and clumsy, Knight painted them quick and lively, a little like the way scientists picture raptors today.

Look closely

- Find the dinosaur that is leaping. Where are its claws?
- Find the dinosaur on its back. What is it doing?
- Is this painting calm or full of action?

Talk about it

1. How did Knight show that these dinosaurs were fast?
2. Do these dinosaurs have feathers? Why do you think Knight did not paint any?

HANDS-ON: RAPTOR REAL SIZE

Compare a real Velociraptor with you.

You will need

- A tape measure
- A large sheet of paper or cardboard, or sidewalk chalk
- A bathroom scale (optional)

Steps

1. Measure 6½ feet on the floor or the sidewalk. Draw a Velociraptor along it: a small head, a body and a long, stiff tail.
2. Mark a height of 1½ feet at the hips. Is that as tall as your knee? Your waist?
3. Draw the sickle claw on its foot, held up off the ground, and feathers on its arms.
4. Optional: weigh yourself. A Velociraptor weighed about 30 to 35 pounds. Are you heavier or lighter?

Check your work

- My raptor is 6½ feet long and about 1½ feet tall at the hips.
- I drew the sickle claw and arm feathers.

FIELD NOTEBOOK

1. Draw a Velociraptor foot and its sickle claw.
2. Write: “A real Velociraptor was about the size of a turkey.”

Did you know? Velociraptor’s brain was large for its body size. Velociraptor ran on two legs and used its stiff tail for balance. The Gobi Desert is also where the first nests of dinosaur eggs to be widely known were found, by the same 1923 expedition.

Museum word. Museum signs say this dinosaur lived in the **Cretaceous**. That is a name scientists use for a group of rock layers and the fossils found in them. Signs often give a date such as “about 75 to 71 million years ago.” That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago. Notice that the Fighting Dinosaurs were buried quickly. Sudden burial is how most good fossils form.

Goes deeper in. Earth Science, Grade 1, Lesson 7.4 “Dinosaur eggs (Roy Chapman Andrews, Gobi, 1923)” (coming soon).

For families. Velociraptor’s size and the 2007 quill-knob study (Turner, Makovicky and Norell) are well documented. Whether feathers mean dinosaurs are related to birds is a

question for later levels; at Scout level the feathers are simply described as what the fossil shows.

PRACTICE

1. **EASY** About how big was a real Velociraptor?
2. **MEDIUM** What did scientists find on a Velociraptor arm bone in 2007, and what does it show?
3. **EASY** In what desert was Velociraptor first found?

Make it a game • Raptor Freeze. Play freeze tag where the “raptor” must walk with one toe lifted (the sickle claw) and the frozen players can be freed by a teammate who flaps “feathered arms.”

Scripture. “He that answereth a matter before he heareth it, it is folly and shame unto him.” (Proverbs 18:13, KJV)

Movies can show things that are not true. A wise person listens to all the evidence before deciding, as scientists did when the real bones showed a turkey-sized raptor.

Practice: answers

1. About the size of a turkey (about 6½ feet long with its tail, 30 to 35 pounds).
2. Quill knobs, which show that Velociraptor had feathers on its arms.
3. The Gobi Desert, in Mongolia.

2.6 ANKYLOSAURUS

OBJECTIVES

- Tell what Ankylosaurus means.
- Describe its armor and tail club.
- Name the fossil hunter who named it.

Warm-up. Knock gently on a turtle shell, a helmet or a hard nut. Feel how hard it is. Ankylosaurus was covered with bony armor like that!

Video slot. Video coming. Armored dinosaurs: Ankylosaurus armor and tail club. Search the American Museum of Natural History, Royal Tyrrell Museum, Smithsonian.

KEY TERMS

armor

A hard covering that protects a body.

osteoderm

A bony plate or knob that grows in the skin (say “OSS-tee-oh-derm”).

tail club

A heavy knob of bone at the end of the tail.

fused

Joined together into one piece.

CORE IDEAS

The story. In 1906, the fossil hunter Barnum Brown, the same man who found T. rex, was digging in Montana when he found pieces of a strange, heavy skull and bony plates. In 1908 he named the animal *Ankylosaurus*, which means “fused lizard,” because many of its bones were **fused**, joined together into one solid piece, like a suit of armor.

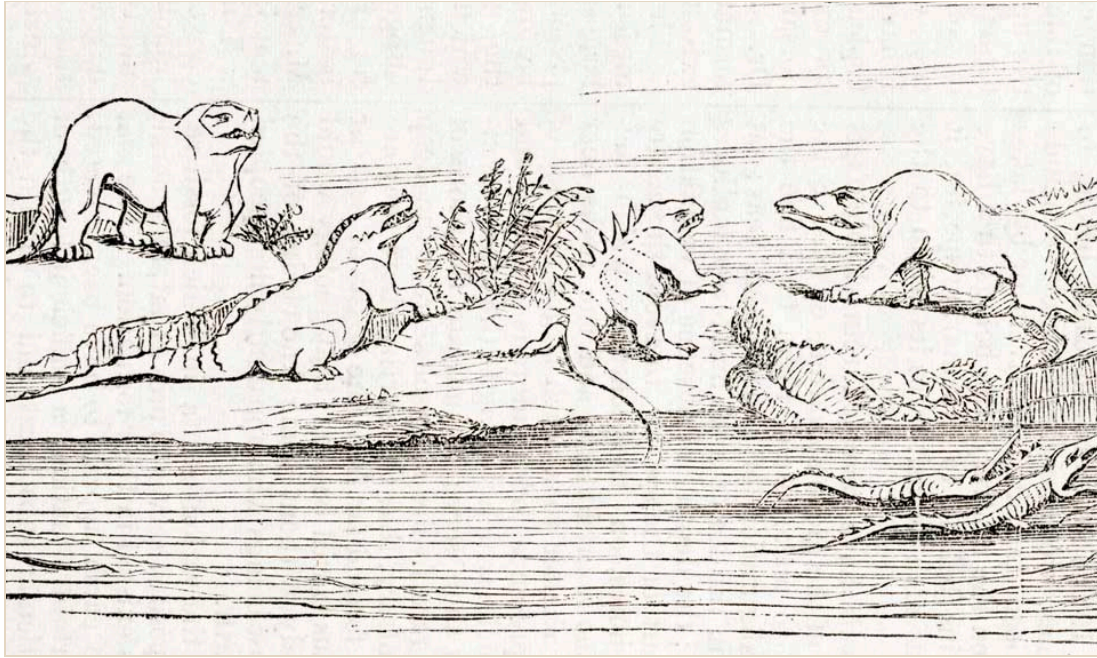
A walking tank. Ankylosaurus was low, wide and heavy, about 20 to 26 feet long. Its back was covered with bony plates and knobs called **osteoderms**, which grew in its skin. Spikes stuck out from its sides and the back of its head. A meat-eater that tried to bite it would get a mouthful of bone!

A club on the tail. At the end of its tail, Ankylosaurus had a big **tail club**, a heavy knob of bone. The back part of its tail was stiff, like a handle. It could swing that club hard from side to side. Scientists think it used the club to defend itself.

A peaceful plant-eater. In spite of all its armor, Ankylosaurus was a plant-eater. It had small, leaf-shaped teeth and a wide beak for cropping low plants. It probably walked slowly, nibbling as it went, like a giant armored cow.

Few fossils. Only a few Ankylosaurus skeletons have ever been found, and none is complete. Much of what we know comes from its cousins, other armored dinosaurs whose fossils are more complete. Scientists put the pieces together like a puzzle.

PICTURE STUDY



Design Drawing for the Crystal Palace Dinosaurs, Benjamin Waterhouse Hawkins, 1854 · Drawing · Crystal Palace Park, London (the statues)
Wikimedia Commons · Public domain

This is the sculptor's plan for his statues. In 1854, Benjamin Waterhouse Hawkins made life-size statues of the first dinosaurs ever named, for a park in London. One of them is *Hylaeosaurus*, an armored dinosaur found in England, a cousin of Ankylosaurus. Only a few bones were known then, so Hawkins had to guess at much of its shape. The statues are still in the park today.

Look closely

- Find a creature with spikes on its back. That is *Hylaeosaurus*.
- Look at the legs. Do these creatures stand tall or lie low, like lizards?
- What do you think Hawkins got right? What might be wrong?

Talk about it

1. How is Hawkins' *Hylaeosaurus* like the Ankylosaurus in our story? How is it different?
2. Why is it hard to make a statue when you have only a few bones?

HANDS-ON: ARMOR TEST

Find out how armor protects a body.

You will need

- Two small balloons (or two eggs, with a grown-up)
- Cardboard and tape
- Bottle caps or pasta shells
- A pillow

Steps

1. Blow up two small balloons. Leave one plain.
2. Make “armor” for the other: tape on cardboard plates and glue bottle caps or pasta shells as osteoderms.
3. Gently poke each balloon with a pencil point (a grown-up helps). Which one is protected?
4. Talk about it: how did Ankylosaurus’s armor protect it?

Tips

- Balloons can pop loudly; be ready! Keep balloon pieces away from little brothers and sisters.

Check your work

- I made bony “armor” for a balloon.
- I tested which balloon was protected.

FIELD NOTEBOOK

1. Draw Ankylosaurus from the top, showing the armor plates and the tail club.
2. Write: “Ankylosaurus means fused lizard.”

Did you know? The Ankylosaurus tail club could be as wide as a big serving platter, about 2 feet across. The armored dinosaurs are called ankylosaurs, after Ankylosaurus. One armored dinosaur from Canada, Borealopelta, was found so well preserved that it looks like a statue, with its armor still in place.

Museum word. Museum signs say this dinosaur lived in the **Cretaceous**. That is a name scientists use for a group of rock layers and the fossils found in them. Signs often give a date such as “68 to 66 million years ago,” the same as T. rex. That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago.

Goes deeper in. Life Science, Grade 2, Lesson 7.2 “Armored dinosaurs” (coming soon).

For families. Ankylosaurus is known from a few partial skeletons; the stop says so plainly. The picture study uses Hawkins’ 1854 Hylaeosaurus, a related armored dinosaur,

because no early fine-art image of Ankylosaurus itself exists.

PRACTICE

1. **EASY** What does Ankylosaurus mean?
2. **EASY** What was at the end of its tail?
3. **MEDIUM** Was Ankylosaurus a plant-eater or a meat-eater? What clue tells us?

Make it a game • Tail Club Bowling. Set up plastic cups as pins. Players swing a sock stuffed with another sock (the tail club) side to side, like Ankylosaurus, to knock them over.

Scripture. “The LORD is my rock, and my fortress, and my deliverer; my God, my strength, in whom I will trust; my buckler, and the horn of my salvation, and my high tower.” (Psalm 18:2, KJV)

Ankylosaurus had armor of bone. God is our armor and fortress, the One who keeps us safe.

Practice: answers

1. “Fused lizard.”
2. A heavy club of bone.
3. A plant-eater; it had small leaf-shaped teeth and a beak for cropping plants.

2.7 SPINOSAURUS

OBJECTIVES

- Describe Spinosaurus's sail, snout and tail.
- Tell how the first Spinosaurus bones were lost.
- Explain how new fossils changed what scientists think.

Warm-up. Hold a paper fan open behind your back. That is a little like the tall “sail” on the back of Spinosaurus. Some of its spines were taller than a grown man!

Video slot. Video coming. Spinosaurus: the sail, the crocodile-like snout and the paddle tail. Search National Geographic Society (vetted per video), Smithsonian.

KEY TERMS

spine

Here, a long rod of bone sticking up from the backbone.

sail

A tall fin of skin held up by long spines along the back.

snout

The nose and jaws of an animal.

paleontologist

A scientist who studies fossils (say “pay-lee-on-TALL-uh-jist”).

CORE IDEAS

The story. In 1912, a fossil collector named Richard Markgraf was digging in the desert of Egypt, near an oasis called Bahariya. He found jaws, teeth and huge spines, some taller than a man. He sent them to a German **paleontologist**, Ernst Stromer, who named the animal in 1915: *Spinosaurus*, “spine lizard.” Stromer kept the bones in a museum in Munich.

Lost in the war. Then came World War II. In 1944, the museum in Munich was destroyed by bombs, and the Spinosaurus bones were destroyed with it. All that was left were Stromer's careful drawings, photographs and notes. For many years, no one knew much more about Spinosaurus.

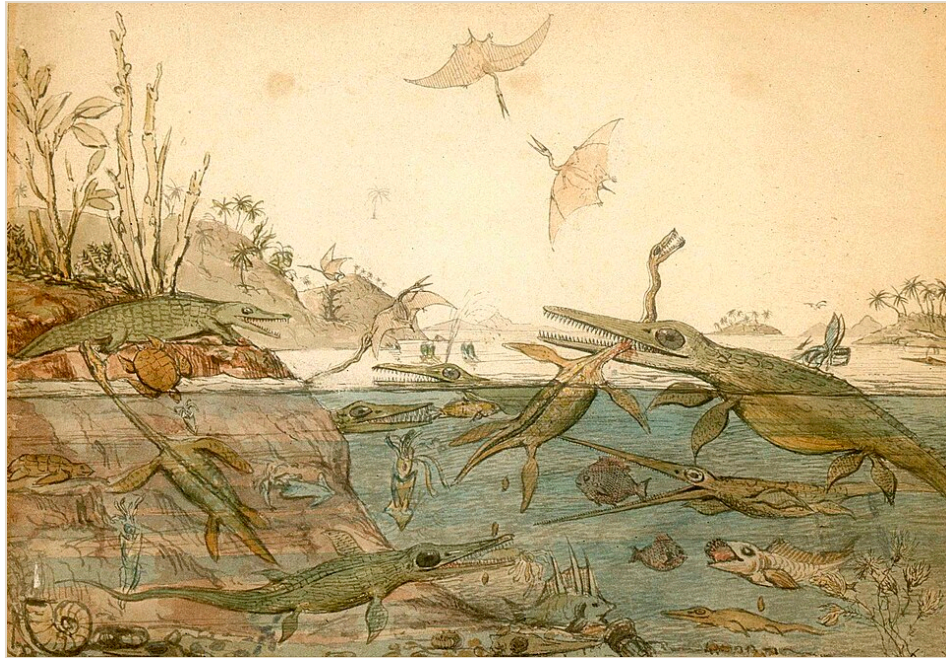
A giant with a sail. From those drawings and from new fossils, we know Spinosaurus was one of the longest meat-eating dinosaurs, perhaps 45 feet long or more, even longer than T. rex. Along its back were tall spines, the longest more than 5 feet high. Skin stretched between them, making a great **sail**.

A fish-eater. Spinosaurus had a long, narrow **snout** like a crocodile's, with cone-shaped teeth good for gripping slippery fish. Its nostrils were set far back on its snout. It lived near

rivers, and it seems to have spent a lot of time in or near the water, catching big fish.

New bones, new ideas. In the 2010s, a paleontologist named Nizar Ibrahim and his team dug up new Spinosaurus bones in Morocco, including a tail. The tail bones had tall spines on top and bottom, making a flat tail like a paddle. Scientists still argue about how well Spinosaurus swam. Each new bone helps us understand it a little better.

PICTURE STUDY



Duria Antiquior (A More Ancient Dorset), Henry De la Beche, 1830 · Watercolor · National Museum Wales, Cardiff (the original); widely printed as a lithograph
Wikimedia Commons · Public domain

Henry De la Beche was an English geologist. In 1830 he painted this scene of ancient sea creatures, based on the fossils that Mary Anning had found on the coast of Dorset. Prints of it were sold to help Mary Anning, who was poor. It is one of the very first pictures ever made of a scene from the world of fossils.

Look closely

- Find a long-necked creature. Find a creature that looks like a fish or a dolphin.
- Look up. What is flying in the sky?
- Is this scene calm or busy?

Talk about it

1. Spinosaurus caught fish in rivers. Which creatures in this painting also hunt fish?
2. Why do you think people in 1830 were amazed by pictures like this?

HANDS-ON: MAKE A SAIL BACK

Build a Spinosaurus sail and see how spines hold up skin.

You will need

- Six drinking straws or wooden skewers (with a grown-up)
- Tissue paper or a paper bag
- Tape and glue
- Clay or a piece of foam

Steps

1. Cut the straws into different lengths: short at the ends, tallest in the middle.
2. Stand them up in a row in a strip of clay. These are the spines.
3. Glue tissue paper across the spines to make the sail.
4. Add a clay body with a long, narrow, crocodile-like snout and a paddle-shaped tail.

Check your work

- My spines are tallest in the middle.
- Skin (paper) stretches between the spines.
- My Spinosaurus has a long narrow snout.

FIELD NOTEBOOK

1. Draw Spinosaurus catching a fish in a river.
2. Write two sentences about how the first Spinosaurus bones were lost and how new ones were found.

Did you know? Ernst Stromer's detailed notes and drawings were so good that scientists still use them today, more than a hundred years later. Spinosaurus had heavy, dense bones, a little like a hippo's or a penguin's, which may have helped it stay under water. Spinosaurus fossils have been found in North Africa, in Egypt and Morocco.

Museum word. Museum signs say this dinosaur lived in the **Cretaceous**. That is a name scientists use for a group of rock layers and the fossils found in them. Signs often give a date such as "about 95 million years ago." That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago.

Goes deeper in. Earth Science, Grade 3, Unit 6 "Dinosaur Digs" (coming soon).

For families. The loss of Stromer's fossils is stated simply. Spinosaurus is an active research topic; the stop presents the 2014 and 2020 finds and notes that scientists still disagree about its swimming.

PRACTICE

1. **EASY** What was on Spinosaurus's back?
2. **MEDIUM** What happened to the first Spinosaurus bones?
3. **MEDIUM** What did Spinosaurus eat? What clue tells us?

Make it a game • Fish Snatch. Scatter paper fish on the floor (the river). Players use kitchen tongs (a long, narrow “snout”) to catch as many fish as they can in 30 seconds.

Scripture. “Or speak to the earth, and it shall teach thee: and the fishes of the sea shall declare unto thee.” (Job 12:8, KJV)

The earth and even its fossils can teach us about the God who made all things.

Practice: answers

1. A tall sail of skin held up by long spines.
2. They were destroyed in 1944, during World War II, when the museum in Munich was bombed.
3. Fish, mostly. Its long narrow snout and cone-shaped teeth were good for gripping slippery fish.

2.8 PARASAUROLOPHUS AND ITS CREST

OBJECTIVES

- Describe the hollow crest of Parasaurolophus.
- Explain how scientists tested the sound the crest could make.
- Tell what a “duck-billed” dinosaur is.

Warm-up. Blow across the top of an empty bottle until it hums. Now try a bigger bottle. Does it make a higher or lower sound? Parasaurolophus had a crest that may have worked like that.

Video slot. Video coming. Parasaurolophus crest and the sound it may have made. Search the Royal Ontario Museum, Smithsonian, New Mexico Museum of Natural History and Science.

KEY TERMS

crest

A bony part sticking up from the top or back of an animal’s head.

hadrosaur

A “duck-billed” dinosaur, with a wide, flat beak.

hollow

Empty inside, like a tube.

CT scan

A machine that uses X-rays to see inside something, slice by slice, without breaking it.

CORE IDEAS

The story. In 1920, a skull with a long, curved crest was found in Alberta, Canada. Two years later, a scientist named William Parks named the dinosaur *Parasaurolophus*, which means “near crested lizard.” Its crest swept back from its head like a long, curved horn.

A trumpet on its head. The crest was not solid bone. Inside were long **hollow** tubes that ran from the nose up into the crest and back down again. What were they for? Many scientists thought the crest might work like a horn or a trombone, making a deep, booming call.

Testing the sound. In the 1990s, scientists in New Mexico took a Parasaurolophus skull and put it through a **CT scan**, which let them see the tubes inside without breaking anything. With a computer, they built a model of the tubes and let air “blow” through them. Out came a deep, low, rumbling sound, like a foghorn or a tuba! No one knows exactly what a real Parasaurolophus sounded like, but the model gives us a good idea.

A duck-billed dinosaur. Parasaurolophus was a **hadrosaur**, a “duck-billed” dinosaur, with a wide, flat beak. Behind its beak were hundreds of small teeth packed together, which ground up tough plants. It was about 30 feet long and could walk on two legs or on all four.

Why a crest? The crest may have helped Parasaurolophus call to its herd, warn of danger, or know others of its own kind. God gave many creatures ways to talk to each other: songs, howls, chirps, and maybe even a dinosaur trumpet.

PICTURE STUDY



Hadrosaurus foulkii, the First Mounted Dinosaur Skeleton, Benjamin Waterhouse Hawkins (mount);
photographer unknown, 1868 · Photograph · Academy of Natural Sciences, Philadelphia
Wikimedia Commons · Public domain

In 1868, in Philadelphia, Benjamin Waterhouse Hawkins put together the bones of *Hadrosaurus*, a duck-billed dinosaur from New Jersey, and stood them up. It was the first dinosaur skeleton ever mounted for people to see. Crowds lined up at the museum. Missing bones were made from plaster.

Look closely

- Find the metal rods holding up the skeleton.
- How is the skeleton standing: on two legs, or four?
- Find the people or objects near it. How big is it?

Talk about it

1. Today scientists think hadrosaurs held their backs more level. How would you stand this skeleton?
2. Why do you think people lined up to see it?

HANDS-ON: BOTTLE CREST ORCHESTRA

Make deep and high sounds with tubes, like a *Parasaurolophus* crest.

You will need

- Three or four empty bottles of different sizes, or paper-towel and wrapping-paper tubes
- Water

Steps

1. Blow across the top of each empty bottle. Which one makes the lowest note?
2. Add water to one bottle. Does the note go up or down?
3. Hum into a short tube and then a long tube. Which sounds deeper?
4. Talk about it: a long, hollow crest could make a deep, low call.

Check your work

- I made notes with bottles or tubes.
- I found that longer air spaces make lower sounds.

FIELD NOTEBOOK

1. Draw *Parasaurolophus* with its crest. Draw dotted lines inside the crest to show the hollow tubes.
2. Write: "Its crest may have worked like a ____." (a horn or trombone)

Did you know? Some duck-billed dinosaurs have been found with fossil skin impressions showing small bumpy scales. Hadrosaurs had hundreds of teeth in rows, stacked so that new teeth replaced worn ones. One of the first good dinosaur skeletons ever found in North America was a duck-billed dinosaur, *Hadrosaurus*, dug up in Haddonfield, New Jersey, in 1858.

Museum word. Museum signs say this dinosaur lived in the **Cretaceous**. That is a name scientists use for a group of rock layers and the fossils found in them. Signs often give a date such as "about 76 to 73 million years ago." That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago.

Goes deeper in. Life Science, Grade 1, Lesson 7.3 "Duck-billed dinosaurs" (coming soon).

For families. The sound model is from a 1997 study at Sandia National Laboratories and the New Mexico Museum of Natural History and Science. The stop presents it as a model, not a recording.

PRACTICE

1. **EASY** What was inside Parasaurolophus's crest?
2. **MEDIUM** How did scientists find out what sound the crest might make?
3. **EASY** What kind of beak did Parasaurolophus have?

Make it a game • Herd Call. Each player picks a secret “call” (hum, whistle or hoot). With eyes closed, players must find their partner who has the same call.

Scripture. “Let every thing that hath breath praise the LORD. Praise ye the LORD.”
(Psalm 150:6, KJV)

Every creature that breathes, from the bird to the great dinosaur, was made to praise God.

Practice: answers

1. Long hollow tubes.
2. They scanned a skull (CT scan), made a computer model of the tubes and “blew” air through them; it made a deep, low sound.
3. A wide, flat “duck bill.”

2.9 PACHYCEPHALOSAURUS

OBJECTIVES

- Tell what Pachycephalosaurus means.
- Describe its thick, domed skull.
- Explain why scientists still argue about head-butting.

Warm-up. Knock gently on your own head. Your skull is about a quarter of an inch thick. The dome on top of a Pachycephalosaurus skull could be about 10 inches thick!

Video slot. Video coming. Pachycephalosaurus domes and the head-butting question. Search the Museum of the Rockies, Smithsonian, Royal Tyrrell Museum.

KEY TERMS

dome

A rounded top, like half of a ball.

skull

The bones of the head.

theory

An idea scientists use to explain something, which they test with evidence.

Hell Creek

A rock formation in Montana and the Dakotas where T. rex, Triceratops and Pachycephalosaurus are found.

CORE IDEAS

The story. Imagine finding a fossil that looks like a big, round, bony bowling ball with knobs around the edges. That is what fossil hunters found in the western United States. In 1943, Barnum Brown and Erich Schlaikjer named the animal *Pachycephalosaurus*, which means “thick-headed lizard.”

A bony helmet. The top of a Pachycephalosaurus skull rose into a high **dome** of solid bone, up to about 10 inches thick. Around the back of the dome were rows of bony knobs and short spikes, and more bumps grew on its snout. It looked like it was wearing a knobby helmet.

Mostly heads. Most Pachycephalosaurus fossils are just skulls, or only the thick domes. The thick bone lasted when the rest of the skeleton was lost. So scientists make their best guess about its body from its smaller cousins. It was probably about 15 feet long, walked on two legs and ate plants, with small leaf-shaped teeth.

Did they bump heads? For many years, people pictured these dinosaurs running at each other and crashing heads together, like rams or mountain goats. Other scientists said a

round dome would slip sideways, and that the dinosaurs more likely pushed each other's sides. Then some scientists found healed injuries on some domes, which may come from hard knocks. The argument is not finished. That is a good lesson: some questions take a long time to answer.

A good theory listens. A **theory** is an idea that tries to explain what we find. A good scientist keeps testing a theory against the evidence, and changes it if he must. Pachycephalosaurus reminds us to be humble about what we know.

PICTURE STUDY



The Iguanodon and the Megalosaurus, Édouard Riou, 1863 · Engraving · From Louis Figuier, *The World Before the Deluge*

Wikimedia Commons · Public domain

Édouard Riou was a French artist who also drew pictures for Jules Verne's adventure books. In 1863 he drew this scene for a book by Louis Figuier called *The World Before the Deluge*. Only a few dinosaur bones were known then, so Riou drew them like giant lizards. Today we know the "horn" on the nose of Iguanodon was really a thumb spike!

Look closely

- Find the horn on one dinosaur's nose. Scientists later learned it belonged on the thumb.
- Do these dinosaurs stand tall or crawl like lizards?
- Look at the trees. What kind of forest is this?

Talk about it

1. How did Riou guess what dinosaurs looked like with only a few bones?

2. Pachycephalosaurus is known mostly from its head. What would you have to guess about its body?

HANDS-ON: DOME DROP TEST

Test whether a round dome or a flat top glances off when it bumps.

You will need

- Two paper or plastic cups
- Half a plastic Easter egg or a ball of clay shaped like a dome
- Tape
- A tray

Steps

1. Tape the dome onto the bottom of one cup. Leave the other cup flat.
2. Slide the two flat cups gently into each other bottom-first. Do they meet squarely?
3. Now slide the dome cup into the flat cup a little off-center. Does it meet squarely, or slip to the side?
4. Talk about it: why do some scientists think round domes would slip, and others think they could still butt heads?

Check your work

- I tested a dome and a flat top.
- I can explain both sides of the head-butting question.

FIELD NOTEBOOK

1. Draw a Pachycephalosaurus skull with its dome and knobs.
2. Write one reason scientists think it butted heads, and one reason some think it did not.

Did you know? Pachycephalosaurus is found in the same rocks as T. rex and Triceratops, in Montana, South Dakota and Wyoming. Young Pachycephalosaurus may have had flatter heads, with the dome growing as they got older. Bighorn sheep, which do butt heads, can run at each other at more than 20 miles an hour.

Museum word. Museum signs say this dinosaur lived in the **Cretaceous**. That is a name scientists use for a group of rock layers and the fossils found in them. Signs often give a date such as “68 to 66 million years ago.” That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago.

Goes deeper in. Life Science, Grade 4, Lesson 7.4 “Ornithischians” (coming soon).

For families. The head-butting debate is real and ongoing; the stop presents both views so children learn that some scientific questions are unsettled.

PRACTICE

1. **EASY** What does Pachycephalosaurus mean?
2. **MEDIUM** Why are most Pachycephalosaurus fossils only skulls?
3. **MEDIUM** Did Pachycephalosaurus butt heads? What is the best answer today?

Make it a game • Gentle Dome Push. Two players stand on one foot, hands on each other's shoulders, and gently push. The first to put the other foot down loses. No head-butting!

Scripture. "A soft answer turneth away wrath: but grievous words stir up anger."
(Proverbs 15:1, KJV)

People do not need to "butt heads." A gentle answer can stop a quarrel before it starts.

Practice: answers

1. "Thick-headed lizard."
2. The thick dome of bone lasted when the rest of the skeleton was lost.
3. Scientists are not sure. Some think the domes were for butting heads (some domes have healed injuries); others think round domes would slip, so they pushed sides instead.

2.10 ARGENTINOSAURUS, ONE OF THE BIGGEST

OBJECTIVES

- Tell how Argentinosaurus was discovered.
- Describe how big it may have been.
- Explain why scientists can only estimate its size.

Warm-up. Stand next to a door. A single backbone of Argentinosaurus was about 5 feet tall, maybe as tall as your mother or father!

Video slot. Video coming. Argentinosaurus bones and the size of the biggest sauropods. Search the Museo Carmen Funes (Plaza Huincul), Fernbank Museum, Smithsonian.

KEY TERMS

titanosaur

A group of very large sauropods, the long-necked plant-eaters, found mostly in South America.

estimate

A careful guess based on what we know.

rancher

A person who raises cattle or sheep on a large farm called a ranch.

petrified wood

Wood that has turned to stone.

CORE IDEAS

The story. In 1987, a rancher named Guillermo Heredia was riding on his land in Neuquén Province, in Argentina, when he saw a huge object sticking out of the ground. He thought it was a log of **petrified wood**. But when scientists from the museum came to dig it up, they found it was a giant bone, a piece of a leg bone from the biggest dinosaur they had ever seen.

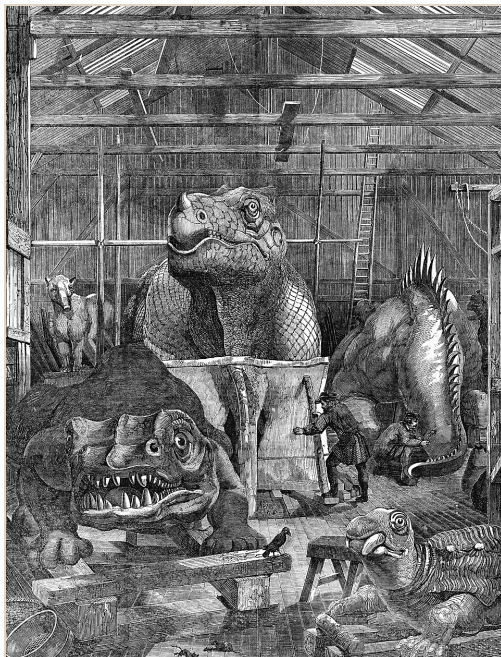
A giant's backbone. As they dug, they found more: pieces of the backbone and ribs. One backbone, called a vertebra, was about 5 feet tall! In 1993, two scientists, José Bonaparte and Rodolfo Coria, named the animal *Argentinosaurus*, "Argentina lizard."

How big? Argentinosaurus was a **titanosaur**, one of the giant long-necked plant-eaters. Scientists **estimate** that it may have been about 100 to 115 feet long, as long as a blue whale, and may have weighed as much as ten elephants or more. It is one of the largest land animals known.

Why only a guess? Only a few bones of Argentinosaurus have ever been found: some backbones, ribs and part of a leg. Scientists compare those bones with the bones of smaller cousins that are more complete, and work out how big the whole animal might have been. That is why the numbers are estimates, and why different books give different sizes.

Great and small. Scientists think giants like Argentinosaurus hatched from eggs only about the size of a grapefruit, like the titanosaur eggs found in Argentina. From that small egg grew one of the biggest creatures God ever made to walk on land. “Great and marvellous are thy works, Lord God Almighty” (Revelation 15:3).

PICTURE STUDY



Mr. Waterhouse Hawkins' Workshop at Sydenham, Unknown engraver for a London newspaper (Commons credits Philip Henry Delamotte), 1853 · Wood engraving · Published in London, 1853
Wikimedia Commons · Public domain

In 1853, the sculptor Benjamin Waterhouse Hawkins built giant dinosaur models in this workshop for Crystal Palace Park in London. On New Year's Eve that year he even held a dinner party for scientists inside the mold of his Iguanodon! Pictures like this show how amazed people were by the size of dinosaurs, even when only a few bones had been found.

Look closely

- Find the workmen. How big are they next to the models?
- Find a model with spikes on its back.
- What tools or ladders can you see?

Talk about it

1. Would you like to eat dinner inside a dinosaur? Why or why not?

2. Argentinosaurus was much bigger than Hawkins' Iguanodon. How many workshops like this might it fill?

HANDS-ON: BIGGEST BACKBONE

Make a life-size Argentinosaurus vertebra out of paper and see how tall it stands.

You will need

- Large cardboard boxes or big sheets of paper taped together
- A tape measure
- Markers
- Tape

Steps

1. Tape paper together until you have a sheet 5 feet tall.
2. Draw one vertebra on it: a round spool at the bottom (the part that held the spinal cord stacked on top) and a tall, wing-shaped spine reaching up.
3. Cut it out with a grown-up and tape it to the wall.
4. Stand beside it and have someone take a picture. Write how tall you are, and how tall the vertebra is.

Check your work

- My vertebra is about 5 feet tall.
- I compared my height to it.

FIELD NOTEBOOK

1. Draw Argentinosaurus next to a blue whale and a school bus.
2. Write: "Scientists estimate its size because only a few bones have been found."

Did you know? Titanosaur nests with many eggs, some with tiny embryos inside, have been found in Argentina at a place called Auca Mahuevo. A life-size cast of Argentinosaurus stands at the Fernbank Museum of Natural History in Atlanta, Georgia. The original Argentinosaurus bones are kept at the Carmen Funes Municipal Museum in Plaza Huincul, Argentina.

Museum word. Museum signs say this dinosaur lived in the **Cretaceous**. That is a name scientists use for a group of rock layers and the fossils found in them. Signs often give a date such as "about 95 million years ago." That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago.

Goes deeper in. Life Science, Grade 6, Lesson 7.3 "How big could a dinosaur get?"

(coming soon).

For families. Size estimates for Argentinosaurus vary widely because the skeleton is very incomplete; the stop gives a range and explains why. The 1853 Iguanodon dinner is well documented and makes a fun bridge to Trail B (Dinosaur Hunters), Stop B5.

PRACTICE

1. **EASY** What did the rancher first think the Argentinosaurus bone was?
2. **EASY** About how long may Argentinosaurus have been?
3. **MEDIUM** Why do books give different sizes for Argentinosaurus?

Make it a game • Smallest to Biggest. Write ten animals and dinosaurs from this trail and the Animals trail on cards. Race to put them in order from smallest to biggest. (Hint: Velociraptor is small; Argentinosaurus and the blue whale are at the top.)

Scripture. “Thou art worthy, O Lord, to receive glory and honour and power: for thou hast created all things, and for thy pleasure they are and were created.” (Revelation 4:11, KJV)

God created all things, from the smallest egg to the biggest dinosaur, and they bring Him glory.

Practice: answers

1. Petrified wood (wood turned to stone).
2. About 100 to 115 feet (an estimate).
3. Only a few bones have been found, so scientists estimate its size by comparing with more complete cousins.

TRACK 2 BADGE QUIZZES

The badge quizzes are optional. Read each question aloud; the child may answer by talking, pointing or drawing. Four right out of five earns the badge. Badges and the certificate are earned by doing the stops, not by scores.

Badge quiz 1 (Stops A1–A5)

1. What does Tyrannosaurus rex mean?
2. How many horns did Triceratops have?
3. What is the funny nickname for the spiky end of a Stegosaurus tail?
4. Why was Brachiosaurus called “arm lizard”?
5. About how big was a real Velociraptor?

Badge quiz 2 (Stops A6–A10)

6. What did Ankylosaurus have at the end of its tail?
7. What was on Spinosaurus’s back?
8. What may the hollow crest of Parasaurolophus have done?
9. What does Pachycephalosaurus mean?
10. Name the three museum words for dinosaur rock layers.

TRAIL CERTIFICATE: MY DINOSAUR FIELD NOTEBOOK AND TRAIL A CERTIFICATE

Gather the Field Notebook pages from this trail into one booklet with a cover: “My Dinosaur Field Notebook,” your name and the dates you started and finished. Add a “Museum words” page that lists Triassic, Jurassic and Cretaceous and the dinosaurs from this trail that museum signs put in each.

When the booklet is done, a parent signs the Trail A certificate.

- **Ten stops:** At least one page for each dinosaur, each with a title and a date.
- **Names:** The meaning of each dinosaur’s name is written on its page.
- **Museum words:** A page lists the period names correctly, with a sentence explaining that dates on signs are interpretations.
- **Care:** Drawings are labeled and done carefully.

Answer key

1. “Tyrant lizard king.”
2. Three (one on the nose and two above the eyes).
3. The thagomizer.
4. Its front legs were longer than its back legs.
5. About the size of a turkey.
6. A heavy club of bone.
7. A tall sail held up by long spines.
8. Made a deep, low call, like a horn or a trombone.

9. "Thick-headed lizard."

10. Triassic, Jurassic and Cretaceous.

SCHOOL LAUNCH · EXPLORE TRACKS

EXPLORE TRACKS · TRAIL B

The second trail of three interest tracks for curious Scouts: Animals (birds), Dinosaurs (the dinosaur hunters) and Great Battles of the Middle Ages. Short, self-paced stops with true stories, great pictures, hands-on projects and games.

First edition

The works of the LORD are great, sought out of all them that have pleasure therein.

Psalm 111:2 (KJV)

COURSE GUIDE

Explore Tracks are for children who want more of what they love. Each track is a trail of short stops. At every stop the child hears a true story, studies a great picture, does something with his or her hands, plays a game and adds a page to a Field Notebook.

Trail B is the second trail of each track at the  Scout level (ages 7-9). The Animals track meets the birds, from the eagle of Isaiah 40:31 to a real backyard bird count. The Dinosaurs track meets the dinosaur hunters, from Mary Anning in 1811 to Mary Schweitzer's soft tissue in 2005, and practices telling observations from interpretations, with a creation-friendly view of the dates on museum signs. The Great Battles track visits eight battles of the Middle Ages, from Tours (732) to Lepanto (1571). Trail A is not required first.

WHO IT IS FOR

Written for children about ages 7-9 who are read to by a parent, or who read short passages on their own. Older siblings can join in. Nothing earlier is required.

HOW TO USE THIS COURSE

1. **One stop at a time.** A stop takes 15-25 minutes: read the story aloud, look at the picture, do the hands-on part and play the game. Two or three stops a week works well.
2. **Any order.** The tracks are independent. Do one track at a time, or rotate between them.
3. **Field Notebook.** Every stop ends with a page for the notebook. At the end of the trail the pages become a booklet, and the parent signs the Trail B certificate.
4. **Badge quizzes.** Each track has two short, optional oral quizzes. They are for fun, not grades.

SCOPE AND SEQUENCE

Track 2: Dinosaurs  Trail B: Dinosaur Hunters (Self-paced)

MATERIALS

- **Field Notebook (a sketchbook or composition book)** One for the whole trail.
- **Colored pencils, a ruler, scissors and glue** For drawings and maps.
- **Household things** Each hands-on project lists what it needs: blocks, clay, string, toy figures, cups.
- **A Bible (KJV)** For the verse at each stop.

GRADING

Explore Tracks are not graded. A stop is done when the child has heard the story, done the hands-on part and made a notebook page.

Badges and the Trail B certificate are earned by finishing the stops.

A NOTE TO PARENTS

You do not need to be an expert. Read the story aloud, look at the picture together and ask, “What do you notice?” Each stop has a short *For families* note with background and any facts that scholars still discuss.

Dinosaur dates: museums give ages in millions of years. This trail teaches the period names as museum words and explains that the dates are interpretations; many Christian families understand the fossils within a young earth and the Flood. Stop B10 (soft tissue) presents the young-earth reading and the discoverer’s own old-earth reading fairly.

Battles are told for young children: who, where, the plan, what happened and why it mattered, with honor for courage, faith and wisdom and no gory detail. Both sides are described fairly, in the terms of their own time.

CONTENTS

Track 2: Dinosaurs 🦖 Trail B: Dinosaur Hunters

- 2.1 Mary Anning, the Girl Who Found a Sea Dragon
- 2.2 William Buckland Names Megalosaurus (1824)
- 2.3 Gideon and Mary Ann Mantell's Iguanodon
- 2.4 Richard Owen Coins "Dinosauria" (1842)
- 2.5 Hawkins' Crystal Palace Dinosaurs (1854)
- 2.6 The Bone Wars: Cope and Marsh
- 2.7 Barnum Brown Finds T. rex (1902)
- 2.8 Roy Chapman Andrews and the Gobi Eggs (1923)
- 2.9 SUE the T. rex (1990)
- 2.10 Mary Schweitzer's Soft Tissue (2005) ⌚

Each stop takes 15–25 minutes. Tracks may be done in any order, and a child may do just one track.

DINOSAURS TRAIL B: DINOSAUR HUNTERS

The second trail of the Dinosaurs track meets the people who found the dinosaurs: Mary Anning on the beach at Lyme Regis, William Buckland and Megalosaurus, the Mantells and Iguanodon, Richard Owen who named the “Dinosauria,” the Crystal Palace sculptures, the Bone Wars of Cope and Marsh, Barnum Brown, Roy Chapman Andrews and the Gobi eggs, SUE the T. rex and Mary Schweitzer’s soft tissue. Each stop is a true story, a picture, something to make, quick questions, a game and Scripture.

This is the  **Scout** level, for ages 7 to 9. The track is creation-friendly: God made the land animals, dinosaurs among them, on the sixth day (Genesis 1:24–25). Period names such as **Jurassic** and **Cretaceous** are taught as “museum words,” and the dates on museum signs are called what they are: interpretations. Stop B10 has the  box: *What the sign says / What we observe / How Christians read it.*

The hunters on this trail made mistakes and fixed them, worked hard, and sometimes quarreled. Their stories show how knowledge grows: by careful looking, by honest correction and by patience. Five stops earn the **Dinosaur Hunter badge, part 1**; ten earn part 2 and the **Trail B certificate**.

BEFORE YOU BEGIN

- Listen to a short story and tell it back.
- Know what a fossil is (Trail A, Stop A1, or ask a grown-up).
- Know the six days of creation from Genesis 1, or read them together first.

MASTERY CHECKLIST

- ☐ I can name five dinosaur hunters and tell what each one found.
- ☐ I can tell the order of three “firsts”: Megalosaurus was named first (1824), Iguanodon second (1825), and the word “dinosaur” came in 1842.
- ☐ I can tell a story about a scientist who changed his mind when better evidence came.
- ☐ I can read the words Jurassic and Cretaceous on a museum sign and say what they name.
- ☐ I can tell the difference between what scientists observe and how they interpret it.

OPTIONAL BOOKS AND RESOURCES

- **Natural History Museum, London** (<https://www.nhm.ac.uk>): Pages on Mary Anning, Megalosaurus, Iguanodon and Richard Owen.
- **Friends of Crystal Palace Dinosaurs** (<https://www.cpdinosaurs.org>): Photos and history of the 1854 sculptures, which still stand in a London park.
- **Field Museum (Chicago): SUE the T. rex** (<https://www.fieldmuseum.org>): SUE’s story and photos for Stop B9.

2.1 MARY ANNING, THE GIRL WHO FOUND A SEA DRAGON

OBJECTIVES

- Tell the story of Mary Anning and the ichthyosaur she and her brother found.
- Explain what a fossil hunter does on a beach after a storm.
- Say why an ichthyosaur is not a dinosaur.

Warm-up. Fill a tray with sand and hide a few small shells or pasta shapes in it. Pour a cup of water gently over one end, like a wave. What comes out? Storms on the beach at Lyme Regis wash fossils out of the cliffs the same way.

Video slot. Video coming. Mary Anning of Lyme Regis and the Jurassic Coast. Search the Natural History Museum (London), Lyme Regis Museum, Simple History or Homeschool Pop (Alternate) once vetted.

KEY TERMS

fossil hunter

A person who searches for fossils and digs them out carefully.

ichthyosaur

A sea reptile shaped like a dolphin, with big eyes and flippers (say “IK-thee-oh-sore”). It means “fish lizard.”

cliff

A high, steep wall of rock.

Jurassic

The museum word for the rock layers at Lyme Regis where Mary Anning found her fossils (say “joo-RASS-ick”).

CORE IDEAS

The story. Long ago in the little town of Lyme Regis, on the south coast of England, lived a poor girl named Mary Anning. Her father made furniture, and on his days off he took Mary and her brother Joseph to the beach below the crumbling gray cliffs. There they hunted for “curiosities,” stone shells and snakes that we now call fossils, and sold them to visitors to help feed the family.

The sea dragon. In 1811, when Mary was about twelve, Joseph found a strange skull sticking out of the cliff. It had a long snout full of teeth and a huge eye. Over the next months, Mary searched the rocks again and again and dug out much of the rest of the skeleton. It was not a crocodile. It was a sea reptile shaped something like a dolphin. Scientists later named it **ichthyosaur**, “fish lizard.”

Hard, careful work. Fossil hunting at Lyme was dangerous. The best time to look was after a storm, when the waves had torn new rock from the cliffs. But storms also caused landslides. Mary learned to watch the tides, to work quickly and to split the stone so carefully that the bones were not broken.

More discoveries. Mary kept hunting all her life. In 1823 she found the first nearly complete **plesiosaur**, a sea reptile with a long neck and four flippers. She also found a flying reptile and many smaller fossils. Famous scientists came to her shop to buy fossils and to learn from her, because she knew more about the bones than many of them did.

Not a dinosaur, but a start. Mary's sea reptiles were not dinosaurs. Dinosaurs lived on land. But her finds helped people see that God had made many great creatures that no one alive had ever seen. They made people want to look for more, and the age of the dinosaur hunters began.

PICTURE STUDY



Mary Anning with her dog Tray, Unknown artist, before 1842 · Oil on canvas · Natural History Museum, London
Wikimedia Commons · Public domain

This painting shows Mary Anning as a grown woman with her fossil hammer and her dog, Tray. Behind her are the cliffs of Lyme Regis where she found her fossils. The painting now belongs to the Natural History Museum in London.

Look closely

- Find Mary's hammer. What did she use it for?
- Find her dog, Tray.
- Look at the cliffs. What do you think is hidden inside them?

Talk about it

1. Why do you think someone painted a portrait of a poor fossil hunter?
2. What tools would you take to hunt fossils on a beach?

Safety first. On a real beach, stay away from the bottom of cliffs, watch the tide with a grown-up, and never climb on crumbling rock.

HANDS-ON: BEACH FOSSIL DIG

Make a “cliff” with hidden fossils and dig them out carefully, like Mary Anning.

You will need

- Plaster of Paris or a thick salt dough
- A plastic tub or a shoebox lined with plastic
- Small shells, plastic dinosaur bones or chicken bones (boiled clean by a grown-up)
- A spoon, an old toothbrush and a craft stick

Steps

1. A grown-up mixes the plaster or dough. Pour a layer into the tub, press in a few “fossils,” and pour another layer on top. Let it harden overnight.
2. Lift out the block. This is your cliff.
3. Use the craft stick and spoon to chip away gently. Brush away the dust with the toothbrush.
4. When a fossil appears, slow down! Dig around it, not on it.
5. Lay your fossils out and draw them in your Field Notebook.

Check your work

- I dug out my fossils without breaking them.
- I drew each fossil I found.

FIELD NOTEBOOK

1. Draw an ichthyosaur. Label the long snout, big eye, flippers and tail.
2. Write: “Mary Anning of Lyme Regis found an ichthyosaur with her brother Joseph.”

Did you know? People often say the tongue twister “She sells seashells by the seashore” was about Mary Anning, but no one has proved it. Mary’s dog, Tray, went with her on her fossil hunts and is in her portrait. The coast at Lyme Regis is still a great place to find fossils, and families hunt there today.

Museum word. Museum signs put these fossils in the **Jurassic**. That is a name scientists use for a group of rock layers and the fossils found in them. The signs at Lyme Regis give a date such as “about 200 to 195 million years ago.” That number is an interpretation, not

something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago. At Lyme the sea creatures lie in thick layers of mud turned to stone. Many Christians read layers like these as laid down in Noah's Flood.

Goes deeper in. Earth Science, Grade 3, "Fossils" and Life Science, Grade 6, "Sea reptiles" (coming soon).

For families. Joseph Anning found the skull in 1811; Mary found most of the skeleton in 1812 (Natural History Museum, London). The first nearly complete plesiosaur was 1823. The "she sells seashells" connection is a popular tradition, not proven. Mary Anning died in 1847; the portrait is dated before 1842. Ichthyosaurs return in Trail E.

PRACTICE

1. **EASY** What did Mary Anning and her brother find in the cliffs in 1811-1812?
2. **MEDIUM** Why was the best time to look for fossils just after a storm?
3. **EASY** Was an ichthyosaur a dinosaur?

Make it a game · Tide's Coming!. Spread paper "fossils" on the floor (the beach). Players hunt and collect them, but when the leader calls "Tide's coming!", everyone must run to the "high ground" (the couch or a rug) before the count of five.

Scripture. "It is the glory of God to conceal a thing: but the honour of kings is to search out a matter." (Proverbs 25:2, KJV)

God hid wonders in the rocks. Searching them out with patience, as Mary Anning did, is an honor.

Practice: answers

1. An ichthyosaur, a "fish lizard" sea reptile.
2. The waves had washed new rock and fossils out of the cliffs.
3. No. It was a sea reptile. Dinosaurs lived on land.

2.2 WILLIAM BUCKLAND NAMES MEGALOSAURUS (1824)

OBJECTIVES

- Tell how Megalosaurus became the first dinosaur to be given a scientific name.
- Explain how a scientist can learn about an animal from only a jawbone.
- Say what Megalosaurus means.

Warm-up. Look at your own teeth in a mirror. Are they all the same shape? From teeth alone, can you guess what you eat? William Buckland did that with the teeth of a giant.

Video slot. Video coming. Megalosaurus and William Buckland at the Oxford University Museum of Natural History. Search the Oxford University Museum of Natural History, the Natural History Museum (London).

KEY TERMS

Megalosaurus

The first dinosaur given a scientific name, in 1824 (say “MEG-a-low-SORE-us”). It means “great lizard.”

jawbone

The bone that holds the teeth.

geologist

A scientist who studies rocks and the earth.

quarry

A place where stone is dug out of the ground.

CORE IDEAS

The story. Near the village of Stonesfield, not far from Oxford in England, workmen dug flat stone out of the ground to make roof tiles. Sometimes they found strange bones in the stone and sold them to collectors. One of those finds was part of a huge lower jaw, with sharp, curved teeth still in it. It came to William Buckland, a teacher at Oxford University.

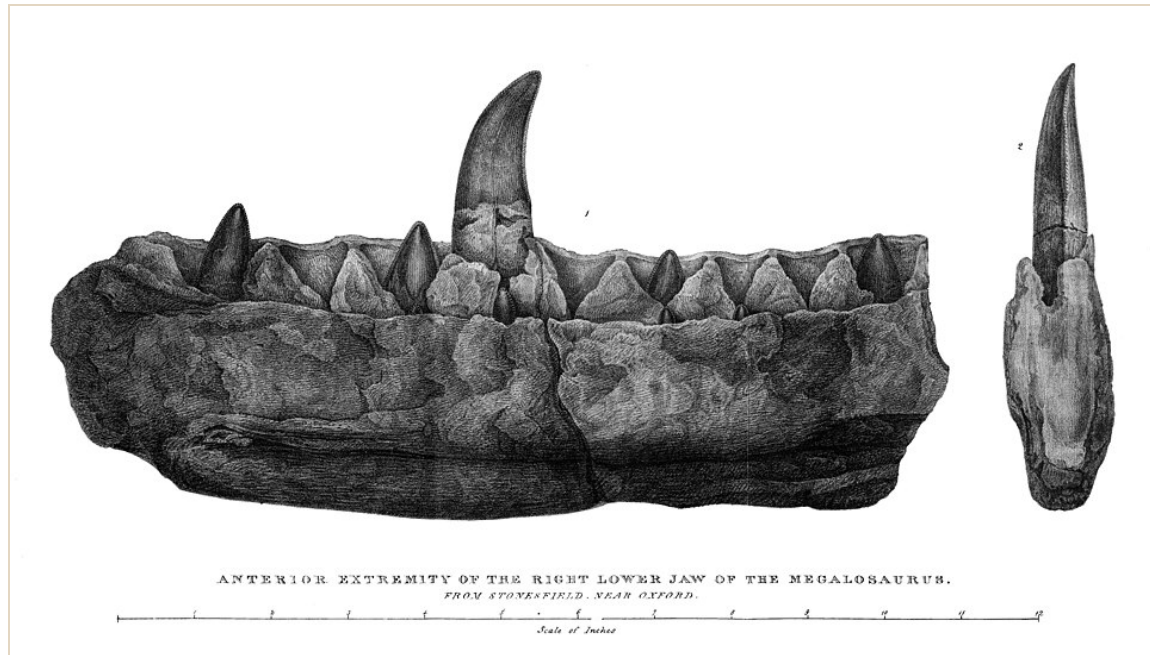
A minister who studied rocks. William Buckland was a minister of the Church of England and a **geologist**. He loved the Bible and he loved rocks, and he taught his students at Oxford about both. He was also a funny, lively man. He gave lectures on horseback, kept a pet bear for a time and filled his house with fossils.

Reading the jaw. Buckland studied the jaw carefully. The teeth were long, flat and curved backward, with tiny saw-like edges, like a steak knife. They grew new teeth as old ones fell out. Buckland could tell it was a giant meat-eating reptile, much bigger than any lizard alive. Some bones of the hip and leg were found too.

The first name. In 1824, Buckland gave a talk in London about the animal. He named it *Megalosaurus*, which means “great lizard.” It was the first dinosaur ever to be given a scientific name, years before anyone used the word “dinosaur” at all.

What we know now. Buckland thought *Megalosaurus* walked on four legs like a giant lizard. Later, when more bones were found, scientists saw that it walked on two strong back legs, more like *T. rex*. This is how science works: people make their best guess from what they have, and when better evidence comes, they change their minds.

PICTURE STUDY



The Megalosaurus jaw, from Buckland's 1824 paper, Engraved plate from William Buckland's paper, 1824 · Engraving · Transactions of the Geological Society of London · Wikimedia Commons · Public domain

This engraving was printed with Buckland's paper on *Megalosaurus*, so that scientists who could not travel to Oxford could see the jaw. Engravers cut the picture into a metal plate line by line.

Look closely

- Count the teeth you can see.
- Look at the tip of one tooth. Is it straight or curved?
- Find a tooth that looks shorter or newer than the others.

Talk about it

1. What do these teeth tell you about what *Megalosaurus* ate?
2. Why was a careful drawing so important in 1824?

HANDS-ON: TOOTH DETECTIVE

Learn to tell meat-eaters from plant-eaters by their teeth, as Buckland did.

You will need

- Clay or play dough
- A plastic knife
- Pictures of a dog's teeth and a horse's or cow's teeth (a book or a grown-up's phone)
- A paper plate

Steps

1. Look at the dog's teeth: pointed and sharp, for meat. Look at the horse's teeth: flat and wide, for grinding plants.
2. Make two clay teeth: one long, curved and pointed, like *Megalosaurus*; one flat, like a plant-eater's.
3. Use the plastic knife to press tiny notches along the edge of the pointed tooth, like a saw.
4. Label them on the plate: "Meat-eater" and "Plant-eater."

Check your work

- I made a meat-eater tooth with saw edges.
- I made a flat plant-eater tooth.
- I can say which kind of tooth *Megalosaurus* had.

FIELD NOTEBOOK

1. Draw the *Megalosaurus* jaw with its curved teeth. Write "*Megalosaurus* = great lizard, named 1824."
2. Draw *Megalosaurus* two ways: on four legs, as Buckland first thought, and on two legs, as we know now.

Did you know? Buckland's *Megalosaurus* jaw is still kept at the Oxford University Museum of Natural History. Charles Dickens put a *Megalosaurus* in the first lines of his novel *Bleak House*, "waddling like an elephantine lizard up Holborn Hill." Gideon Mantell gave *Megalosaurus* its full two-part name, *Megalosaurus bucklandii*, in Buckland's honor.

Museum word. Museum signs put these fossils in the **Jurassic**. That is a name scientists use for a group of rock layers and the fossils found in them. Signs for *Megalosaurus* often give a date such as "about 166 million years ago." That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago.

Goes deeper in. Earth Science, Grade 3, "Fossils" (coming soon).

For families. Buckland described *Megalosaurus* to the Geological Society of London in February 1824; the species name *bucklandii* was added by Mantell in 1827 (Natural History Museum; Oxford University Museum of Natural History). Buckland was an Anglican clergyman (later Dean of Westminster). He first argued for the Flood as the cause of certain deposits (*Reliquiae Diluvianae*, 1823) and later moved to an old-earth view; the Ranger level says so. His pet bear is a well-known Oxford story.

PRACTICE

1. **EASY** What does *Megalosaurus* mean?
2. **MEDIUM** What could Buckland tell from the teeth?
3. **MEDIUM** What did scientists later change their minds about?

Make it a game • First! Second! Third!. Make three cards: “*Megalosaurus* named, 1824,” “*Iguanodon* named, 1825” and “The word dinosaur, 1842.” Shuffle them and race to put them in order. Add more cards as you go along the trail.

Scripture. “The works of the LORD are great, sought out of all them that have pleasure therein.” (Psalm 111:2, KJV)

This is our tracks verse. Buckland took pleasure in seeking out God’s works in the rocks.

Practice: answers

1. “Great lizard.”
2. That it was a giant meat-eater: the teeth were sharp, curved and saw-edged.
3. *Megalosaurus* walked on two legs, not four.

2.3 GIDEON AND MARY ANN MANTELL'S IGUANODON

OBJECTIVES

- Tell how the Mantells found the teeth of Iguanodon.
- Explain why the name Iguanodon means “iguana tooth.”
- Tell the story of the “horn” that turned out to be a thumb.

Warm-up. Put your thumb up, like “thumbs up.” Now put it on your nose. Silly! But that is just where scientists first put the thumb spike of Iguanodon.

Video slot. Video coming. Iguanodon and Gideon Mantell: the teeth, the thumb spike and the changing pictures. Search the Natural History Museum (London), the Royal Belgian Institute of Natural Sciences (the Bernissart Iguanodons).

KEY TERMS

Iguanodon

A big plant-eating dinosaur, the second dinosaur ever named (say “ig-WAN-oh-don”). It means “iguana tooth.”

iguana

A large plant-eating lizard that lives in warm places today.

thumb spike

A big, cone-shaped bone on Iguanodon’s hand.

reconstruction

A drawing or model of what an animal looked like, made from its bones.

CORE IDEAS

The story. Gideon Mantell was a busy country doctor in the town of Lewes, in the south of England. When he was not caring for sick people, he hunted fossils in the rocks of the Sussex countryside. His wife, Mary Ann, helped him. She was a skilled artist and drew many of his fossils for his books.

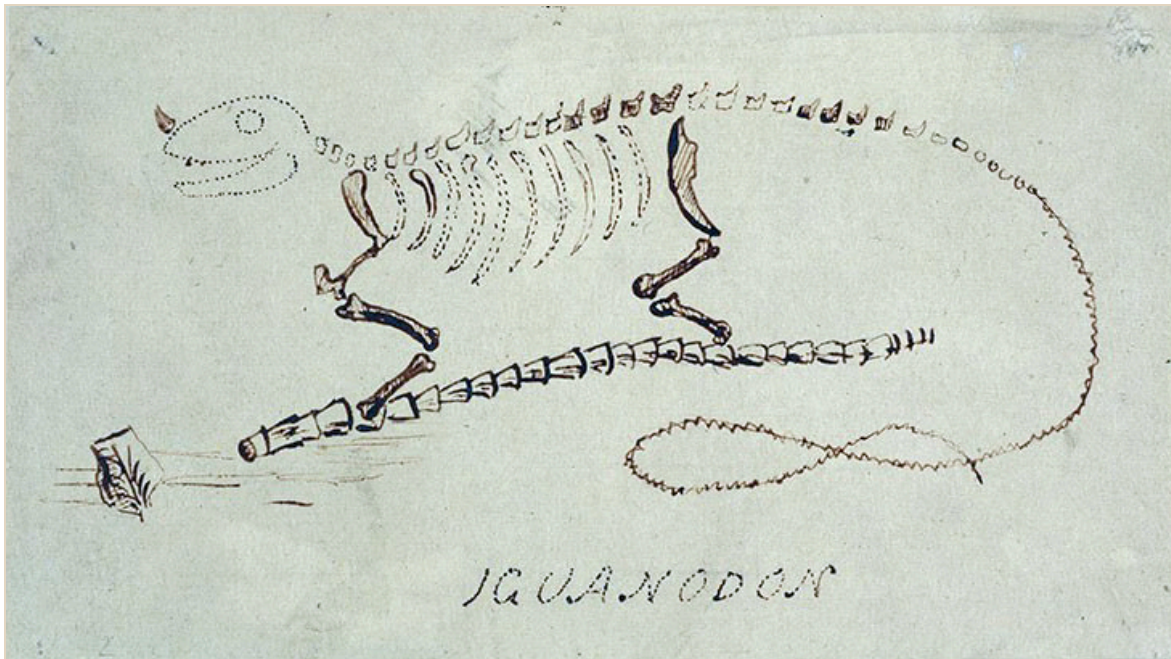
The strange teeth. Around 1822, the Mantells found some large, worn teeth in a pile of road-building stone. They looked like the teeth of a plant-eater, but they were much too big for any animal Gideon knew. A family story says that Mary Ann found the first ones while Gideon was visiting a patient. Whoever saw them first, Gideon set out to learn what they were.

The iguana clue. Gideon showed the teeth to experts. Some said they were from a fish or a mammal. Then, at a museum in London, a young scientist showed him the skeleton of an iguana, a plant-eating lizard. Its teeth had the same shape, only tiny! In 1825, Gideon named the animal *Iguanodon*, “iguana tooth.” It was the second dinosaur to be named.

The horn that was a thumb. Later, more bones were found, including a cone-shaped spike. Gideon guessed it was a horn and drew it on Iguanodon's nose, like a rhinoceros. Many years afterward, in 1878, miners in Belgium found more than thirty Iguanodon skeletons together in a coal mine. Now scientists could see the whole animal. The "horn" was really a big spike on its **thumb**!

Patient and humble. Gideon Mantell worked hard all his life and was often tired and poor. Still, he kept studying. His story shows that the first guess is not always right, and that is all right. A good scientist keeps looking and is willing to say, "I was wrong."

PICTURE STUDY



Mantell's sketch of Iguanodon, Gideon Mantell, about 1834 · Pen and pencil sketch · Natural History Museum, London
Wikimedia Commons · Public domain

Gideon Mantell made this sketch of what he thought Iguanodon looked like, using the bones he had. He put the spike on its nose. We know now that the spike was on its thumb.

Look closely

- Find the spike. Where did Mantell put it?
- How many legs is the animal standing on?
- Does it look more like a lizard or a dinosaur you know?

Talk about it

1. Why did Mantell make a mistake about the spike?
2. What would you change in this drawing now that you know more?

HANDS-ON: FIX THE IGUANODON

Draw Iguanodon twice: the way Mantell first thought it looked, and the way scientists picture it now.

You will need

- Paper folded in half
- Pencil and crayons
- A ruler

Steps

1. On the left half, draw a long, low lizard on four sprawling legs with a horn on its nose. Write “1834.”
2. On the right half, draw a big dinosaur standing on strong back legs with its front hands touching the ground, a stiff tail held out, and a spike on each thumb. Write “Today.”
3. Circle the thumb spike in red on both drawings.
4. Tell a grown-up what changed and why.

Check your work

- I drew both Iguanodons.
- I circled the thumb spike.
- I can tell why the picture changed: more bones were found.

FIELD NOTEBOOK

1. Draw an Iguanodon hand with its thumb spike.
2. Write: “Iguanodon means iguana tooth. Named 1825.”

Did you know? Iguanodon may have been about 30 feet long. The Belgian Iguanodons from the coal mine at Bernissart still stand in a museum in Brussels. One of Mantell’s Iguanodon bones was found in a quarry in Maidstone, and the town now has an Iguanodon on its coat of arms.

Museum word. Museum signs put these fossils in the **Cretaceous**. That is a name scientists use for a group of rock layers and the fossils found in them. Signs for Iguanodon often give a date such as “about 125 million years ago.” That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago. Notice that the Belgian Iguanodons were found together, many at once. Many Christians see mass burials like this as a sign of sudden flooding.

Goes deeper in. Earth Science, Grade 3, “Fossils” and Life Science, Grade 2, Lesson 7.2 “Plant-eating dinosaurs” (coming soon).

For families. The teeth were found around 1822; the story that Mary Ann found them first comes from Gideon's later accounts and is doubted by some historians, so the stop presents it as a family story (Natural History Museum, London). The name *Iguanodon* was published in 1825. The Bernissart Iguanodons were found in 1878 (Royal Belgian Institute of Natural Sciences). The iguana comparison was made with help from Samuel Stutchbury at the Hunterian Museum.

PRACTICE

1. **EASY** What does Iguanodon mean?
2. **MEDIUM** Where did Mantell first put the spike, and where was it really?
3. **EASY** How did Mary Ann Mantell help her husband?

Make it a game · Pin the Spike on the Iguanodon. Draw a big Iguanodon on paper and tape it to the wall. Players are blindfolded and try to stick a paper thumb spike in the right place: on the thumb, not the nose!

Scripture. "The heart of the prudent getteth knowledge; and the ear of the wise seeketh knowledge." (Proverbs 18:15, KJV)

Gideon Mantell kept seeking knowledge all his life. A wise person keeps learning and listening.

Practice: answers

1. "Iguana tooth."
2. He put it on the nose like a horn; it was really on the thumb.
3. She hunted fossils with him and drew them for his books.

2.4 RICHARD OWEN COINS “DINOSAURIA” (1842)

OBJECTIVES

- Tell who made up the word “dinosaur” and when.
- Say what “dinosaur” means.
- Name the three animals Owen used to make the new group.

Warm-up. Make up a new word for a group of things, like “fluffacorns” for fluffy animals with horns. Richard Owen made up a new word for a group of giant reptiles, and now the whole world uses it.

Video slot. Video coming. Richard Owen and the Natural History Museum in London; the word “dinosaur.” Search the Natural History Museum (London), Simple History, Homeschool Pop (Alternate) once vetted.

KEY TERMS

Dinosauria

The name Richard Owen gave in 1842 to a new group of reptiles. It means “terrible lizards” or “fearfully great lizards.”

anatomist

A scientist who studies how bodies are built.

group

A set of animals that are alike in important ways.

museum

A building where important things are kept and shown so people can learn.

CORE IDEAS

The story. By 1841, scientists in England knew of three giant reptiles from the bones in the rocks: Megalosaurus, Iguanodon and an armored animal called Hylaeosaurus. Were they just huge lizards? Richard Owen, a brilliant **anatomist** in London, did not think so.

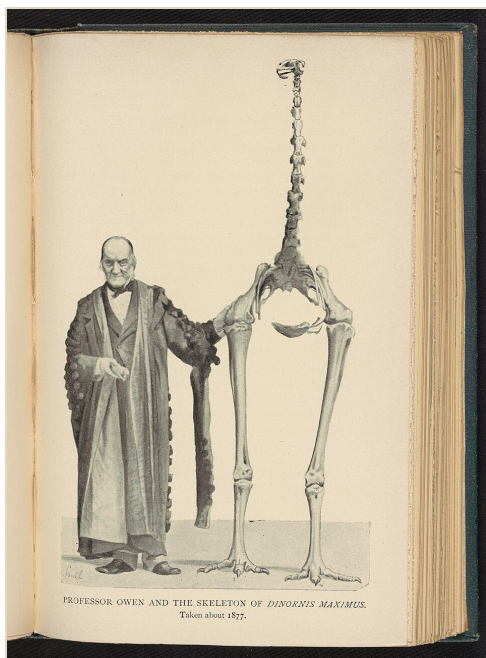
A new kind of reptile. Owen looked closely at the bones. He saw that these animals had legs that stood straight under the body, like an elephant’s, not sprawled out to the side like a lizard’s. Their hip bones were joined together strongly to carry great weight. He decided they were a new **group**, different from any reptile alive today.

A name for the group. Owen made up a name from two Greek words: *deinos*, meaning “terrible” or “fearfully great,” and *sauros*, meaning “lizard.” In his report, printed in 1842, he called the group **Dinosauria**. That is where our word “dinosaur” comes from.

A home for the bones. Owen wanted everyone, rich and poor, to be able to see God's works in nature. He worked for many years to build a great museum in London for fossils, animals, plants and rocks. The Natural History Museum opened in 1881. It is so grand that people call it a "cathedral of nature," and carvings of animals cover its walls.

A man with faults too. Owen was very clever, but he could also be proud and unkind. He sometimes took credit for other people's work, including some of Gideon Mantell's. The Bible teaches that pride goes before a fall, and many people in Owen's day came to dislike him for it. We can honor his good work and learn from his mistakes.

PICTURE STUDY



*Richard Owen with a moa skeleton, Photograph, about 1877 · Photograph · From Owen's Memoirs on the Extinct Wingless Birds of New Zealand
Wikimedia Commons · Public domain*

Richard Owen studied the giant moa, a huge bird of New Zealand that is gone now. Here he stands beside a moa skeleton, holding a bone like the one he first studied. Owen was an anatomist, so bones were his books.

Look closely

- Compare the man and the bird skeleton. Which is taller?
- Find the bone Owen is holding.
- Look at the legs of the moa. Are they thick or thin?

Talk about it

1. What could Owen learn from a single bone?
2. Why do you think he wanted his photograph taken with the skeleton?

HANDS-ON: LIZARD LEGS OR DINOSAUR LEGS?

See why Owen thought dinosaurs were different from lizards.

You will need

- Your own body
- A toy lizard and a toy dinosaur, or pictures
- A piece of paper and pencil

Steps

1. Do a push-up position with your elbows bent out to the sides. Walk on hands and feet like this. That is how a lizard's legs sprawl.
2. Now stand up straight, with your legs right under your body. That is how a dinosaur's legs stood.
3. Which way could hold up more weight? Which way could you walk farther?
4. Draw a lizard from the front with sprawling legs, and a dinosaur from the front with straight legs.

Check your work

- I tried both ways of walking.
- I drew sprawling legs and straight legs.
- I can say why straight legs help a heavy animal.

FIELD NOTEBOOK

1. Write the word DINOSAUR in big letters. Under "DINO" write "terrible / fearfully great." Under "SAUR" write "lizard."
2. Draw Megalosaurus, Iguanodon and Hylaeosaurus, the first three dinosaurs.

Did you know? Hylaeosaurus, the third dinosaur in Owen's group, means "woodland lizard." It had spikes and armor on its back. Owen also studied the giant moa birds of New Zealand, and there is a famous photograph of him with a moa skeleton. Some people prefer to translate "dinosaur" as "fearfully great lizard," because Owen wanted to show how wonderful they were, not only how scary.

Museum word. Dinosaurs are sorted into a group by their bones, especially the hips and legs. That part is observation. Signs that say dinosaurs "ruled the earth for 165 million years" add an interpretation of time. Read the bones; question the dates.

Goes deeper in. Earth Science, Grade 3, "Fossils" and Composition, "Word roots" (coming soon).

For families. Owen presented the idea in his 1841 report to the British Association, published in 1842 (Natural History Museum, London). The three founding genera were

Megalosaurus, *Iguanodon* and *Hylaeosaurus*. The museum opened at South Kensington in 1881. Owen opposed Darwin's theory of natural selection; at the Scout level the stop does not go into that debate. His treatment of Mantell is well documented.

PRACTICE

1. **EASY** Who made up the word "dinosaur"?
2. **MEDIUM** What does "dinosaur" mean?
3. **MEDIUM** How were dinosaur legs different from lizard legs?

Make it a game · Dino or Not?. The leader names an animal: Triceratops, ichthyosaur, crocodile, Stegosaurus, plesiosaur, T. rex, iguana. Players stand straight like a dinosaur if it is a dinosaur, and sprawl on the floor if it is not.

Scripture. "I will praise thee; for I am fearfully and wonderfully made: marvellous are thy works; and that my soul knoweth right well." (Psalm 139:14, KJV)

Owen's word means "fearfully great." The Bible says we too are "fearfully and wonderfully made." All God's works are marvelous.

Practice: answers

1. Richard Owen, in 1842.
2. "Terrible lizard" or "fearfully great lizard."
3. They stood straight under the body instead of sprawling out to the sides.

2.5 HAWKINS' CRYSTAL PALACE DINOSAURS (1854)

OBJECTIVES

- Tell the story of the first life-size dinosaur sculptures.
- Explain what the sculptures got right and what they got wrong.
- Make a model dinosaur from a skeleton drawing.

Warm-up. Look at a bone from a chicken dinner (washed clean). Can you imagine what the whole chicken looked like from just that bone? Benjamin Waterhouse Hawkins had to do that for whole dinosaurs.

Video slot. Video coming. The Crystal Palace dinosaurs today, in Crystal Palace Park, London. Search the Friends of Crystal Palace Dinosaurs, Historic England, the Natural History Museum (London).

KEY TERMS

sculptor

An artist who makes statues and models.

life-size

The same size as the real thing.

model

A copy of something, often to show how it looks.

restoration

A picture or model showing how a living thing may have looked.

CORE IDEAS

The story. In 1852, a great glass building called the Crystal Palace was moved to a new park in south London. The owners wanted something amazing for the park. They asked an artist named Benjamin Waterhouse Hawkins to make life-size models of the great animals known only from their bones. No one had ever tried such a thing.

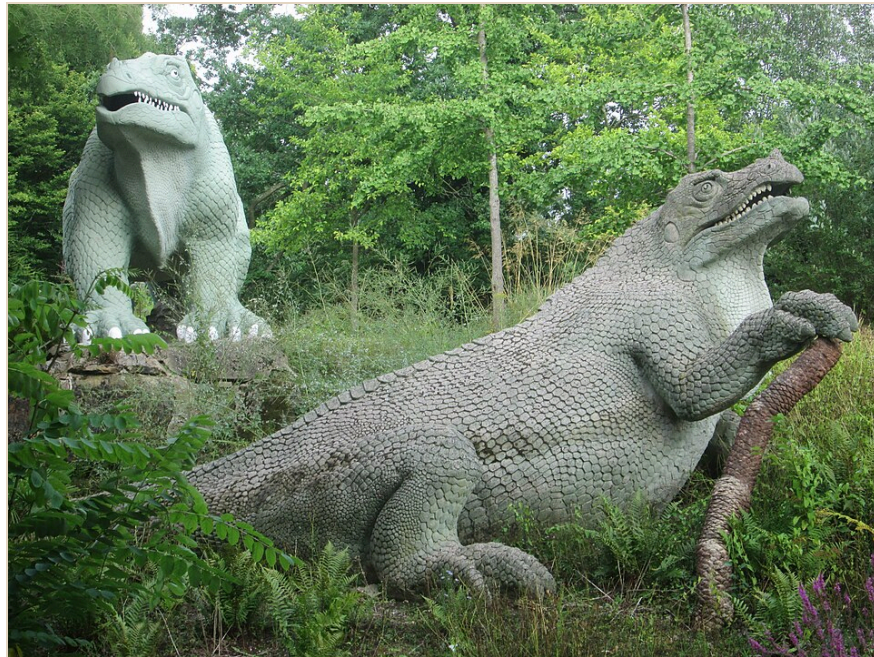
Building giants. Hawkins worked with Richard Owen, who told him what the bones showed. Then he built the models with iron frames, bricks and tiles covered with cement, like small buildings. Some were as long as a bus. He made Megalosaurus and Iguanodon, the sea reptiles of Mary Anning, flying reptiles and great mammals.

Dinner in a dinosaur. On New Year's Eve, 1853, Hawkins held a party. He invited twenty-one scientists and guests to dinner, and eleven of them sat at a table inside the mold of the Iguanodon! Richard Owen sat in the head. They ate a fine meal, made speeches and sang songs into the night.

Opening day. In June 1854, Queen Victoria opened the new Crystal Palace. Thousands of people walked through the park and saw the dinosaurs standing by the lake. For the first time, ordinary people could look a dinosaur in the eye.

Right and wrong. Hawkins and Owen did their best with the few bones they had. They made the dinosaurs big, heavy and standing on straight legs, and that was right. But they put the Iguanodon on four legs with a horn on its nose, like a giant rhinoceros, and that was wrong. The models still stand in the park today, and they are a reminder that our pictures of the past can change.

PICTURE STUDY



*The Crystal Palace Iguanodons today, Benjamin Waterhouse Hawkins (sculptor); photograph by Peter S (geograph.org.uk), sculptures 1852-1854; photograph 2017 · Brick, iron and cement sculptures; color photograph · Crystal Palace Park, London
Wikimedia Commons · CC BY-SA 2.0*

This photograph shows Hawkins' Iguanodons as they stand today in Crystal Palace Park. They have been repaired and repainted over the years, but they are the same models people saw in 1854.

Look closely

- Find the horn on the nose. Where should it really be?
- Count the legs touching the ground.
- Look at the plants and water around them. Why do you think Hawkins put them by a lake?

Talk about it

1. How would you feel seeing these as a child in 1854?

2. Should the park fix the mistakes, or keep them as they are? Why?

HANDS-ON: BONES TO BODY

Make a model dinosaur the way Hawkins did: from the skeleton out.

You will need

- Pipe cleaners or aluminum foil (the frame)
- Clay or salt dough (the body)
- A picture of a dinosaur skeleton (from Trail A or a library book)
- Paint (optional)

Steps

1. Look at the skeleton picture. Bend pipe cleaners into a backbone, four legs and a tail. This is your iron frame.
2. Cover the frame with clay, a little at a time, following the shape of the bones.
3. Add the head, eyes and claws.
4. When it is dry, paint it any color you like. (Remember, we do not know dinosaur colors!)

Check your work

- My model has a frame inside.
- I followed the skeleton picture.
- I can tell what Hawkins got right and wrong.

FIELD NOTEBOOK

1. Draw Hawkins' Iguanodon (four legs, nose horn) and the Iguanodon of today (thumb spikes). Label the differences.
2. Write: "On New Year's Eve, 1853, eleven men ate dinner inside an Iguanodon."

Did you know? The Crystal Palace building burned down in 1936, but the dinosaurs survived. The Crystal Palace dinosaurs are protected by law as Grade I listed monuments, the same as famous castles. Later, in 1868, Hawkins helped put together a Hadrosaurus skeleton in Philadelphia, one of the first dinosaur skeletons ever mounted in a museum.

Museum word. The sculptures were made by men who believed God created all things. Owen's signs did not need big numbers to amaze people; the bones themselves were enough. On a museum sign today, look for two parts: what the bones show (size, teeth, legs) and the dates added to them.

Goes deeper in. Art, "Sculpture" and Earth Science, Grade 3, "Fossils" (coming soon).

For families. Dinner facts (21 guests, 11 inside the mold, Owen at the head, December 31, 1853) follow the Friends of Crystal Palace Dinosaurs and the *Illustrated London News*

report of January 1854. The Crystal Palace at Sydenham opened on June 10, 1854. The sculptures were upgraded to Grade I listed in 2007 (Historic England). The Hadrosaurus mount (Academy of Natural Sciences, Philadelphia) was 1868. Trail A's Stop A10 mentioned the dinner briefly.

PRACTICE

1. **EASY** Who made the Crystal Palace dinosaurs?
2. **EASY** Where did the famous New Year's Eve dinner take place?
3. **MEDIUM** Name one thing the models got right and one they got wrong.

Make it a game • Statue Park. Players are Crystal Palace dinosaurs. When the music plays, they move like dinosaurs; when it stops, they freeze as statues. The leader walks through the "park" and tries to make a statue laugh.

Scripture. "O LORD, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches." (Psalm 104:24, KJV)

The crowds in 1854 marveled at the dinosaurs. The Psalm reminds us whose works they really are.

Practice: answers

1. Benjamin Waterhouse Hawkins, with advice from Richard Owen.
2. Inside the mold of the Iguanodon model.
3. Right: big, heavy, straight legs. Wrong: Iguanodon on four legs with a horn on its nose.

2.6 THE BONE WARS: COPE AND MARSH

OBJECTIVES

- Tell the story of Edward Drinker Cope and Othniel Charles Marsh.
- Name three dinosaurs they found.
- Explain how envy hurt the two men, even while their work helped science.

Warm-up. Think of a time you wanted to win so badly that you were not kind. How did it end? Two great dinosaur hunters let that feeling run their whole lives.

Video slot. Video coming. The Bone Wars of Cope and Marsh and the dinosaurs of the American West. Search the Yale Peabody Museum, the Academy of Natural Sciences (Philadelphia), Simple History or Extra History once vetted.

KEY TERMS

rival

Someone you are trying to beat.

envy

Being unhappy that someone else has something you want.

expedition

A long trip to explore or to collect things.

badlands

Dry, rocky land with steep hills and gullies, where fossils are easy to see.

CORE IDEAS

The story. In the 1860s, two young American scientists became friends. Edward Drinker Cope lived in Philadelphia. Othniel Charles Marsh taught at Yale College. They had both studied fossils in Europe, and they even named fossil animals after each other. But soon their friendship turned into a bitter rivalry, and it lasted the rest of their lives. People call it the **Bone Wars**.

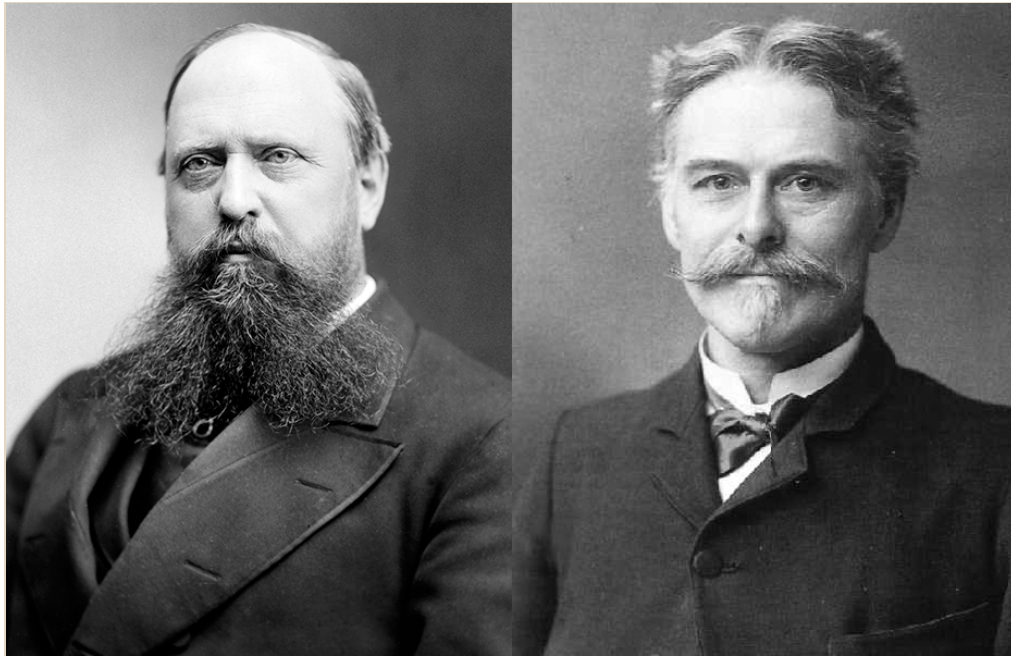
The head on the wrong end. Cope put together the bones of a long-necked sea reptile called *Elasmosaurus*. But he put its head on the end of its tail! When other scientists pointed it out, Marsh made sure everyone heard about it. Cope was embarrassed and angry. Marsh also paid Cope's fossil diggers to send bones to him instead. The two men became **rivals**.

A race across the West. In the 1870s, railroads were reaching the American West, and huge bones were being found in the **badlands** of Colorado, Wyoming and Montana. Cope and Marsh sent out teams to dig as fast as they could. Their teams spied on each other, and some even smashed bones they could not take so the other side could not have them.

So many dinosaurs. In their race, the two men named many new dinosaurs. Marsh named Stegosaurus, Triceratops, Allosaurus and Diplodocus. Cope named Camarasaurus and Coelophysis. Marsh named about 80 new kinds of dinosaurs, and Cope about 56. Before them, only a handful of dinosaurs were known in North America.

What envy costs. But the Bone Wars cost the two men dearly. They spent their money, lost friends and attacked each other in the newspapers. Both died poorer and less honored than they could have been. Their bones fill museums today, but their story is a warning. The Bible says, “Envy the rottenness of the bones” (Proverbs 14:30). Envy eats a person up from the inside.

PICTURE STUDY



Othniel Charles Marsh (left) and Edward Drinker Cope (right), Photographs (Marsh by the Brady-Handy studio; Cope by Frederick Gutekunst), before 1897 · Two photographs side by side · Library of Congress and other collections (via Wikimedia Commons)
Wikimedia Commons · Public domain

These are photographs of the two rivals. On the left is Othniel Charles Marsh of Yale. On the right is Edward Drinker Cope of Philadelphia. Both were brilliant and hardworking, and both were proud.

Look closely

- Which man has the bigger beard?
- Look at their faces. How do they look to you: friendly, serious, proud?
- Look at their clothes. Are they dressed for a dig or for the city?

Talk about it

1. If these two men had been friends, what might they have found together?

2. Is it ever right to be glad when someone else makes a mistake?

HANDS-ON: DIG AND SHARE

Play a fossil dig two ways, first as rivals and then as partners, and see which works better.

You will need

- Two trays of sand or dirt
- Small toy bones, pasta or shells buried in each
- Two spoons and two brushes
- A timer

Steps

1. Round 1 (rivals): two players each dig in their own tray for two minutes. No sharing tools, no helping. Count the fossils each found.
2. Round 2 (partners): bury the fossils again. This time the two players work together on one tray at a time, one digging and one brushing.
3. Count again. Which round found more fossils? Which was more fun?
4. Talk about it: what might Cope and Marsh have found if they had worked together?

Check your work

- I played both rounds.
- I can tell which way worked better.
- I can name one dinosaur Marsh named and one Cope named.

FIELD NOTEBOOK

1. Draw two men pulling a big bone in a tug-of-war. Write: "The Bone Wars, Cope and Marsh."
2. List three dinosaurs Marsh named and two Cope named.

Did you know? Some of Marsh's and Cope's boxes of bones were still unopened many years after they died. Marsh's fossils are in the Yale Peabody Museum and the Smithsonian; many of Cope's are in New York and Philadelphia. Marsh named a sauropod *Brontosaurus*, "thunder lizard," in 1879. Scientists argued for years about whether it was really *Apatosaurus*.

Museum word. Museum signs put these fossils in the **Jurassic**. That is a name scientists use for a group of rock layers and the fossils found in them. Many of the Bone Wars dinosaurs come from a rock layer in the West called the Morrison Formation. Signs often give it a date such as "about 150 million years ago." That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land

animals, dinosaurs included, on the sixth day of creation, only thousands of years ago. At places like Como Bluff, Wyoming, bones of many dinosaurs lie jumbled together.

Goes deeper in. Earth Science, Grade 5, “The American West” and History, “The railroads” (coming soon).

For families. Species counts (Marsh about 80 new dinosaur species, Cope about 56) follow the UC Museum of Paleontology and standard histories; totals vary by how species are counted. Joseph Leidy first pointed out the *Elasmosaurus* error (1868–1870); Marsh publicized it. The newspaper attacks peaked in the *New York Herald* in 1890. The *Brontosaurus/Apatosaurus* question was reopened in 2015.

PRACTICE

1. **EASY** Who were the two rivals in the Bone Wars?
2. **MEDIUM** Name three dinosaurs Marsh named.
3. **MEDIUM** What did envy do to Cope and Marsh?

Make it a game · Bone Wars Tag (Friendly Version). Hide paper bones around the yard. Two teams race to find them, but every bone must be shared at the end to build one big skeleton on the ground together. The team that adds the head gets to name the dinosaur.

Scripture. “A sound heart is the life of the flesh: but envy the rottenness of the bones.” (Proverbs 14:30, KJV)

A dinosaur hunter’s verse! Envy rotted the friendship of Cope and Marsh. A heart at peace is healthy.

Practice: answers

1. Edward Drinker Cope and Othniel Charles Marsh.
2. Any three: *Stegosaurus*, *Triceratops*, *Allosaurus*, *Diplodocus*, *Brontosaurus*.
3. It made them waste money, lose friends and attack each other; both ended their lives poorer and less honored.

2.7 BARNUM BROWN FINDS T. REX (1902)

OBJECTIVES

- Tell the story of Barnum Brown and his discovery in Montana.
- Explain how a dinosaur skeleton is dug up and carried to a museum.
- Say why the first T. rex skeleton is now in Pittsburgh.

Warm-up. Wrap a toy or a cookie in wet paper towel, then cover it with strips of paper and glue or tape. Let it dry. You have just made a field jacket, like the ones Barnum Brown used to protect dinosaur bones.

Video slot. Video coming. Barnum Brown and the T. rex at the American Museum of Natural History; how a field jacket is made. Search the American Museum of Natural History, the Carnegie Museum of Natural History.

KEY TERMS

field jacket

A hard shell of plaster and cloth wrapped around a fossil to protect it on the trip to the museum.

excavate

To dig something up carefully.

Hell Creek

The name of the rock layers in Montana where T. rex was found.

specimen

One fossil or skeleton that scientists study.

CORE IDEAS

The story. Barnum Brown was born on a farm in Kansas in 1873. His parents named him after P. T. Barnum, the famous circus showman. As a boy he collected fossils and shells he found when the plow turned up the earth. He grew up to be a fossil hunter for the American Museum of Natural History in New York, and he was so good at finding bones that people called him “Mr. Bones.”

Bones in the badlands. In the summer of 1902, Brown was searching the dry hills and gullies of **Hell Creek**, in eastern Montana. There he found the bones of a giant meat-eater: part of the skull, the backbone and the hips. In 1905 the museum named it *Tyrannosaurus rex*, the “tyrant lizard king.” (Trail A, Stop A1, tells about T. rex itself.)

Hard work. Digging out a dinosaur is hard. The rock was so heavy that Brown sometimes used dynamite to blast away the top layers. Then his team dug with picks and brushes. They wrapped each bone in burlap soaked in plaster to make a hard **field jacket**, like a cast for a

broken arm. The bones went by horse-drawn wagon to the railroad and then by train to New York.

An even better T. rex. In 1908 Brown found a second T. rex with a much better skull. That skeleton was put together and still stands in the American Museum of Natural History in New York, where millions of people have seen it.

Kept safe. In 1941, during World War II, the museum sold the first T. rex, the one from 1902, to the Carnegie Museum in Pittsburgh. Brown said he was worried that New York might be bombed, and this way the two skeletons would not be in the same place. (The museum also needed money for more digging.) That first T. rex is still in Pittsburgh today.

PICTURE STUDY



Barnum Brown doing field work in Montana, Photograph, 1914 · Photograph · American Museum of Natural History expedition photograph (via Wikimedia Commons)
Wikimedia Commons · Public domain

This photograph shows Barnum Brown in 1914, at work in the badlands of Montana. Look at his famous long fur coat! The rocks behind him are the kind of crumbly cliffs where fossil hunters search for bones.

Look closely

- What is Barnum Brown wearing?
- Look at the rocks. Are they hard and smooth, or crumbly and full of layers?
- Where would you start looking for bones in this place?

Talk about it

1. Would you like to be a fossil hunter? What part would be hardest?
2. Why is it important to write down where each bone was found?

HANDS-ON: MAKE A FIELD JACKET

Protect a “fossil” for the trip to the museum, the way Barnum Brown did.

You will need

- A “fossil”: a cookie, a clean chicken bone or a clay bone
- Wet paper towel
- Strips of newspaper or cloth
- Flour-and-water paste or white glue mixed with water
- A bowl

Steps

1. Lay the fossil on a tray. Cover it with wet paper towel, so the jacket will not stick to the bone.
2. Dip the strips in the paste and lay them over the fossil, crisscrossing, until it is covered on top and sides.
3. Let it dry until hard (overnight).
4. Flip it over and jacket the bottom.
5. Later, “open it at the museum”: cut the jacket carefully with a grown-up and see if your fossil survived the trip.

Check your work

- My jacket covered the whole fossil.
- My fossil came out without breaking.
- I can tell why fossil hunters use field jackets.

FIELD NOTEBOOK

1. Draw Barnum Brown in his long coat, digging out a T. rex skull.
2. Make a map: Montana (where T. rex was found), New York (the museum) and Pittsburgh (where the first T. rex is now). Draw lines between them.

Did you know? Barnum Brown often wore a long fur coat, a tie and a hat while hunting fossils, even out in the badlands. Brown also traveled down the Red Deer River in Canada on a flatboat, finding dinosaurs along the riverbanks. Brown worked for the American Museum of Natural History for more than sixty years.

Museum word. Museum signs put these fossils in the **Cretaceous**. That is a name scientists use for a group of rock layers and the fossils found in them. Signs about the Hell Creek rocks often give a date such as “about 66 million years ago.” That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago.

Goes deeper in. Earth Science, Grade 3, Lesson 6.2 “Sue the T. rex” (coming soon).

For families. The 1902 Hell Creek find (later the holotype, CM 9380) went to the Carnegie Museum of Natural History in 1941; the 1908 skeleton (AMNH 5027) is on display at the AMNH (Carnegie Museum; AMNH). The sale price was \$7,000. Brown gave fear of wartime bombing as the reason; NPR (2011, quoting Mark Norell) reports that his letters suggest the museum also wanted cash for fieldwork, so the stop gives both (Carnegie Magazine, Fall 2021, also cites a dwindling budget). Osborn named the animal in 1905. Brown’s use of dynamite and his fur coat are well documented in photographs and biographies.

PRACTICE

1. **EASY** Who found the first T. rex skeleton, and where?
2. **MEDIUM** What is a field jacket for?
3. **MEDIUM** Why did Brown say the first T. rex should go to Pittsburgh in 1941?

Make it a game • Bone Train. Players carry “jacketed” bones (pillows) one at a time from the “dig” across the yard to the “railroad” (a line of chairs). Each pillow must be carried by two players together. Load the whole skeleton onto the train!

Scripture. “And whatsoever ye do, do it heartily, as to the Lord, and not unto men;” (Colossians 3:23, KJV)

Barnum Brown worked hard for more than sixty years. Whatever our work, we do it heartily, for the Lord.

Practice: answers

1. Barnum Brown, at Hell Creek in Montana, in 1902.
2. It protects fossil bones on the trip from the dig to the museum.
3. He was worried New York might be bombed in World War II, so both T. rex skeletons should not be in one place.

2.8 ROY CHAPMAN ANDREWS AND THE GOBI EGGS (1923)

OBJECTIVES

- Tell the story of the expedition that found the first nest of dinosaur eggs known to science.
- Find the Gobi Desert and Mongolia on a map.
- Tell how Oviraptor got a name that turned out to be unfair.

Warm-up. Hold a raw egg (carefully!) and a hard-boiled egg. Can you tell which is which by looking? Scientists had to work hard to find out what was inside the Gobi eggs too.

Video slot. Video coming. Roy Chapman Andrews, the Flaming Cliffs and the Gobi dinosaur eggs; Oviraptor on its nest. Search the American Museum of Natural History.

KEY TERMS

Gobi Desert

A large, dry, rocky desert in Mongolia and China.

Mongolia

A country in Asia between Russia and China.

nest

A place where eggs are laid.

embryo

A baby animal growing inside an egg.

CORE IDEAS

The story. In the 1920s, an explorer named Roy Chapman Andrews led a great expedition into the Gobi Desert of Mongolia for the American Museum of Natural History. The team drove Dodge cars across the desert, and a long caravan of camels carried gas, food and supplies. Andrews wore a wide hat and carried a pistol, because there were bandits about. He loved adventure!

The Flaming Cliffs. One evening the team came to tall red sandstone cliffs that glowed like fire in the setting sun. They named them the Flaming Cliffs. The cliffs were full of fossils, especially a small horned dinosaur that was later named Protoceratops.

“Eggs are eggs.” On July 13, 1923, a team member named George Olsen came back to camp at lunch and said he had found fossil eggs. The others laughed. Surely they were just odd-shaped rocks! But they went to look, and there lay several long eggs with wrinkled shells, broken out of the rock. Andrews wrote that at last they had to admit “eggs are eggs.” It was the first nest of dinosaur eggs known to science.

The “egg thief.” Lying right on top of the nest was the skeleton of a small, toothless dinosaur. Scientists thought the eggs belonged to Protoceratops and that this little dinosaur had died while stealing them. So they named it *Oviraptor*, which means “egg thief.”

The truth comes out. Seventy years later, in 1993, scientists in Mongolia found an egg just like these with a tiny **embryo** inside. The baby was an Oviraptor! And later they found Oviraptor-like dinosaurs sitting on nests with their arms spread over the eggs, like a mother hen. Oviraptor was not stealing the eggs. It was probably guarding its own. Its name is still “egg thief,” but now everyone knows it was a parent.

PICTURE STUDY



A nest of oviraptorid eggs from Mongolia, Photograph by “Gerbil”, 2006 · Photograph of fossil dinosaur eggs · Senckenberg Museum, Frankfurt, Germany · Wikimedia Commons · CC BY-SA 3.0

This photograph shows a fossil nest of long eggs from Mongolia, like the ones the 1923 expedition found. The museum’s sign says these eggs were first thought to belong to Protoceratops, until embryos and parents on nests showed they were laid by Oviraptor’s family. The eggs lie in a ring, in pairs.

Look closely

- Count the eggs you can see.
- Look at the shape of the eggs. Are they round or long?
- Look at the way the eggs are arranged. Is there a pattern?

Talk about it

1. Why would a parent dinosaur arrange its eggs in a circle?
2. How do you think the scientists felt when they found an embryo inside?

HANDS-ON: A DINOSAUR NEST

Make a nest of “dinosaur eggs” and guard it like an Oviraptor parent.

You will need

- Salt dough or clay (2 cups flour, 1 cup salt, about 3/4 cup water)
- A paper plate
- Brown paint or cocoa powder
- A toothpick

Steps

1. Shape 8 to 12 long eggs, each about as long as your finger.
2. Scratch little wrinkles into the shells with the toothpick.
3. Arrange the eggs in a circle on the plate with their narrow ends pointing to the middle, in two rings if you can.
4. Let them dry, then paint them brown and gray like fossil stone.
5. Make an Oviraptor from clay sitting in the middle with its arms spread over the eggs.

Check your work

- My eggs are long, not round.
- They are arranged in a circle.
- My Oviraptor is guarding the nest, not stealing it.

FIELD NOTEBOOK

1. Draw the Oviraptor sitting on its nest with its arms spread. Write: “Oviraptor means egg thief, but it was a parent.”
2. Draw a map of Asia and mark Mongolia and the Gobi Desert.

Did you know? The first nest found at the Flaming Cliffs had about 13 eggs. Each egg was about 6 to 8 inches long, longer than a chicken egg but much narrower than an ostrich egg. The team also found the first Velociraptor skull there, in 1923 (see Trail A, Stop A5).

Museum word. Museum signs put these fossils in the **Cretaceous**. That is a name scientists use for a group of rock layers and the fossils found in them. Signs for the Flaming Cliffs often give a date such as “about 75 million years ago.” That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago. Notice that whole nests and a parent were buried in place by sand. Something covered them very suddenly.

Goes deeper in. Geography, “Asia: Mongolia and China” and Life Science, Grade 2, “Eggs and babies” (coming soon).

For families. Date (July 13, 1923), finder (George Olsen) and Andrews’s “eggs are eggs” are from the AMNH and Andrews’s *The New Conquest of Central Asia* (1932). Dinosaur eggshell had been found earlier in France, so “first nest known to science” is the careful wording. The embryo (found 1993, published by Norell and others in *Science*, 1994) and the brooding oviraptorids (1995) are AMNH work. The common claim that Andrews inspired Indiana Jones is not included because it is unconfirmed.

PRACTICE

1. **EASY** Where was the first nest of dinosaur eggs found in 1923?
2. **MEDIUM** Why was Oviraptor named “egg thief”?
3. **MEDIUM** What showed that Oviraptor was really a parent?

Make it a game • Guard the Nest. One player is the Oviraptor parent and sits by a “nest” of balls or beanbags. The others try to sneak up and take an egg. If the parent tags you, you freeze. Can the parent guard every egg?

Scripture. “He that is first in his own cause seemeth just; but his neighbour cometh and searcheth him.” (Proverbs 18:17, KJV)

The first story about Oviraptor sounded right. When people searched more, the truth came out. We should be careful before we judge.

Practice: answers

1. At the Flaming Cliffs in the Gobi Desert of Mongolia.
2. Its skeleton was found on a nest, and scientists thought it was stealing eggs.
3. An embryo of an Oviraptor-like dinosaur was found inside an egg like these, and others were found sitting on nests.

2.9 SUE THE T. REX (1990)

OBJECTIVES

- Tell the story of how SUE was found.
- Describe why SUE is so important.
- Measure and compare SUE’s size with things you know.

Warm-up. Pick up your heaviest book. Now think: SUE’s skull alone weighs about 600 pounds, as much as three or four grown men!

Video slot. Video coming. SUE the T. rex at the Field Museum: the skeleton, the skull and how SUE was found. Search the Field Museum.

KEY TERMS

SUE

The name of the most complete Tyrannosaurus rex skeleton found so far, named after Sue Hendrickson.

complete

Having all or nearly all of its parts.

auction

A sale where people bid against each other and the highest bid wins.

injury

A hurt or wound. SUE’s bones show old injuries that healed.

CORE IDEAS

The story. On a hot August morning in 1990, a team of fossil hunters was camped near the town of Faith, South Dakota. Their truck had a flat tire, so most of the team drove to town to fix it. Sue Hendrickson stayed behind with her dog. She walked to a sandstone cliff she had been wanting to explore. At its foot she saw pieces of bone, and when she looked up, there were huge bones sticking out of the cliff. It was a T. rex!

A very complete T. rex. The team dug out the skeleton over many days. It was the biggest and most **complete** T. rex anyone had ever found. They named it SUE, after Sue Hendrickson. Scientists still do not know whether SUE was a male or a female; “SUE” is just its name.

Who owns a dinosaur? Then came a problem. The bones were found on land where a rancher lived, but the government held that land in trust for him. Who owned SUE? The question went to court. In 1992, officers took the bones away and stored them while the judges decided. At last the court ruled that SUE belonged to the rancher.

Sold to Chicago. In 1997, SUE was sold at an **auction** in New York. The Field Museum in Chicago, with help from companies and friends, bought SUE for more than eight million dollars. Scientists spent years cleaning the bones and putting them together. In 2000 SUE was shown to the world.

What SUE tells us. SUE is about 40 feet long and stood about 13 feet tall at the hips. Its bones show many old **injuries** that healed: broken ribs, a hurt leg, and holes in the jaw that may have come from an infection. SUE lived a hard life, but its body healed again and again. God made bodies able to mend.

PICTURE STUDY



SUE the T. rex at the Field Museum, Photograph by Michael Gray, 2006 · Photograph · Field Museum, Chicago

Wikimedia Commons · CC BY-SA 2.0

This photograph, taken in 2006, shows SUE standing in the great hall of the Field Museum in Chicago. In 2018 SUE moved to a new room of its own in the museum.

Look closely

- Find the skull. Is it the real one or the lighter copy? (The copy is on the skeleton.)
- Count the toes on one foot.
- Find the tiny arms. How long are they compared with the legs?

Talk about it

1. How would you feel standing under SUE?
2. Why do you think so many people wanted to own SUE?

Safety first. Stay out of the street. Measure in a yard, park or quiet driveway with a grown-up.

HANDS-ON: HOW BIG IS SUE?

Mark out SUE's length and height outside.

You will need

- A tape measure or a 10-foot string
- Sidewalk chalk
- A grown-up helper

Steps

1. Mark a starting line for SUE's nose. Measure 40 feet (four times your 10-foot string) and mark the tip of the tail.
2. Mark where the skull ends, about 5 feet from the nose.
3. Find a wall or a tree and have a grown-up measure 13 feet up. That is the top of SUE's hips.
4. Walk from nose to tail and count your steps.

Check your work

- I marked 40 feet.
- I found 13 feet up on a wall or tree.
- I counted my steps.

FIELD NOTEBOOK

1. Draw SUE's skull. Write: "SUE, found August 12, 1990, by Sue Hendrickson, South Dakota."
2. Write one injury that SUE's bones show.

Did you know? SUE's skull is so heavy that the real skull is kept in its own case, and a lighter copy sits on the skeleton. SUE has about 250 of the bones a T. rex body would have had, about 90 percent by bulk. SUE was found on August 12, 1990.

Museum word. Museum signs put these fossils in the **Cretaceous**. That is a name scientists use for a group of rock layers and the fossils found in them. The Field Museum's sign gives SUE an age of about 67 million years. That number is an interpretation, not something anyone saw. This course reads Genesis as teaching that God made the land animals, dinosaurs included, on the sixth day of creation, only thousands of years ago. SUE was found mostly together, in a sandstone that had been a river or flood deposit.

Goes deeper in. Earth Science, Grade 3, Lesson 6.2 “Sue the T. rex” (coming soon).

For families. Facts follow the Field Museum: found August 12, 1990, near Faith, South Dakota; about 40.5 feet long and 13 feet at the hips; about 90 percent of the skeleton by bulk; bought at Sotheby’s in October 1997 for about \$8.4 million; unveiled May 2000. The ownership case is told simply (the land was held in trust by the federal government for the rancher Maurice Williams; the court awarded SUE to him). SUE’s sex is unknown.

PRACTICE

1. **EASY** Who found SUE, and where?
2. **MEDIUM** Why was there a court case about SUE?
3. **EASY** Which museum has SUE now?

Make it a game • Flat Tire!. Play like Red Light, Green Light. The leader calls “Drive!” and players walk, and “Flat tire!” and everyone stops. The first player to reach the leader “finds SUE” and becomes the next leader.

Scripture. “Bless the LORD, O my soul, and forget not all his benefits: Who forgiveth all thine iniquities; who healeth all thy diseases;” (Psalm 103:2-3, KJV)

SUE’s bones show wounds that healed. God made living things able to heal, and He heals us, body and soul.

Practice: answers

1. Sue Hendrickson, near Faith, South Dakota, in 1990.
2. People disagreed about who owned the bones, because the land was held in trust by the government for a rancher.
3. The Field Museum in Chicago.

2.10 MARY SCHWEITZER'S SOFT TISSUE (2005)

OBJECTIVES

- Tell the story of the soft tissue found inside a T. rex bone.
- Tell the difference between what scientists observe and how they interpret it.
- Read a museum sign and sort it into “what we see” and “what people think.”

Warm-up. Bend a rubber band. It stretches and snaps back. Now tap a rock. It does not bend at all. Scientists expected dinosaur bones to be all rock inside. What Mary Schweitzer found bent like the rubber band!

Video slot. Video coming. Mary Schweitzer and soft tissue in a T. rex bone. Search the Smithsonian (Smithsonian Magazine “Dinosaur Shocker”), North Carolina State University; for creation-friendly framing, Answers in Genesis or Institute for Creation Research videos once vetted.

KEY TERMS

soft tissue

Body parts that are soft, like skin, blood vessels and muscles, not hard like bone.

blood vessel

A tiny tube that carries blood through the body.

observe

To see, measure or test something for yourself.

interpret

To explain what something means. Two people can observe the same thing and interpret it differently.

CORE IDEAS

The story. In 2000, a fossil hunter named Bob Harmon was eating his lunch in a canyon in Montana when he looked up and saw a bone sticking out of a cliff. It was a T. rex! The team dug it out over three summers. The bones were so heavy in their plaster jackets that the helicopter could not lift them, so the workers had to break one big thighbone into pieces.

A surprise inside. The broken pieces were sent to Mary Schweitzer, a scientist in North Carolina. She soaked a piece in a gentle acid to take away the hard minerals. Usually nothing is left. But this time, something soft and stretchy remained. Under the microscope she saw tiny, clear, branching tubes, like **blood vessels**, and small round shapes like cells. When she pulled the material, it stretched and sprang back.

The world hears. In 2005, Dr. Schweitzer and her team reported their find in a science journal. People were amazed. Most scientists had taught that soft tissue could not last for

millions of years. Dr. Schweitzer said she checked her results again and again before she believed them, because she wanted to be sure.

Observe and interpret. Here is a big lesson for every dinosaur hunter. To **observe** is to see or test something for yourself: “This material is soft and stretchy.” To **interpret** is to explain what it means: “It is millions of years old” or “It is only thousands of years old.” Good scientists, and good students, keep the two apart.

Two ways of reading it. Many Christians who believe the earth is young say soft tissue fits with bones buried in Noah’s Flood only thousands of years ago. Dr. Schweitzer, who is a Christian too, thinks something in the bone, like iron from the blood, may have kept the tissue for millions of years. Scientists keep testing. As you read the box below, notice which part is the observation and which parts are interpretations.

PICTURE STUDY



The skull of “B. rex” (MOR 1125), Photograph by Tim Evanson, 2015 · Photograph · Museum of the Rockies, Bozeman, Montana
Wikimedia Commons · CC BY-SA 2.0

This is the skull of the very T. rex whose thighbone held the soft tissue. It is nicknamed “B. rex” after Bob Harmon, who found it. It is on display at the Museum of the Rockies in Montana.

Look closely

- Count the teeth you can see on the bottom jaw.
- Find the big openings in the skull. What do you think filled them in life?
- Look at the color and the surface. Does it look like stone or like bone?

Talk about it

1. What would you expect to find inside a bone this old?
2. Why is it important to look for yourself instead of only being told what is there?

HANDS-ON: OBSERVE OR INTERPRET?

Practice keeping what you see apart from what you think it means.

You will need

- Six index cards and a pencil
- A museum sign: from a museum visit, a museum website, or the sample in the box below
- Two bowls labeled “I observe” and “Interpretation”

Steps

1. A grown-up writes these on cards: “This bone is 4 feet long.” “This dinosaur lived 68 million years ago.” “The bone has soft, stretchy tissue inside.” “This T. rex was a mother.” “The teeth are sharp and curved.” “Dinosaurs ruled the earth.”
2. Read each card and drop it in the right bowl. Can you see or measure it? Then it is an observation. Is it an explanation or a guess about the past? Then it is an interpretation.
3. Read a real museum sign. Underline the observations in one color and the interpretations in another.
4. Talk about it: which parts of the sign does everyone agree on?

Tips

- “This T. rex was a mother” is an interpretation of an observation: Dr. Schweitzer saw a special kind of bone that female birds make before laying eggs.

Check your work

- I sorted all six cards.
- I can give one example of an observation and one of an interpretation.
- I marked a real museum sign in two colors.

FIELD NOTEBOOK

1. Make two columns: “I observe” and “Interpretation.” Write two sentences in each about the soft tissue.
2. Draw a magnifying glass looking at a tiny branching blood vessel.

Did you know? Dr. Schweitzer’s team later found tiny bits of protein called collagen in dinosaur bones, the same protein that is in your own bones. Since 2005, other teams have reported soft tissue or traces of protein in other dinosaur fossils too. Dr. Schweitzer first studied to be a teacher before she became a scientist.

 **What the sign says / What we observe / How Christians read it.**  **What the sign says:** “This Tyrannosaurus lived about 68 million years ago.” **What we observe:** inside a T. rex thighbone from Montana, Mary Schweitzer’s team found soft, stretchy material and tiny branching tubes like blood vessels; later tests found traces of protein. **How Christians read it:** many young-earth Christians see soft tissue as a sign that the bones are thousands, not millions, of years old, buried in the Flood. Dr. Schweitzer, who is herself a Christian, thinks the tissue may have lasted millions of years because iron from the blood helped preserve it. Scientists are still testing both ideas. What everyone agrees on is the observation: something soft was found inside a dinosaur bone.

Goes deeper in. Earth Science, the creation and dating units, and Trail D, Stop D9 “Soft tissue and dating” (coming soon).

For families. This is a  stop. The find was published by Schweitzer, Wittmeyer, Horner and Toporski in *Science* 307 (March 25, 2005); the specimen is MOR 1125, found by Bob Harmon in 2000 in the Hell Creek Formation, and the femur was broken for helicopter transport (Smithsonian Magazine, 2006). The iron-preservation hypothesis is Schweitzer et al., *Proc. R. Soc. B* (2014). Dr. Schweitzer has spoken publicly about her Christian faith; she holds an old-earth view. Young-earth organizations (e.g., Answers in Genesis, Institute for Creation Research) read the finding as evidence for a young earth. The stop presents both fairly and teaches the observation/interpretation distinction.

PRACTICE

1.  What did Mary Schweitzer find inside the T. rex bone?
2.  Is “This tissue is stretchy” an observation or an interpretation?
3.  Is “This bone is 68 million years old” an observation or an interpretation?

Make it a game · See It or Say It?. The leader says a sentence about something in the room: “The cup is blue” (see it!) or “Someone was thirsty” (say it!). Players touch their eyes for an observation and their chin for an interpretation.

Scripture. “Prove all things; hold fast that which is good.” (1 Thessalonians 5:21, KJV)

To “prove” means to test. Dinosaur hunters test what they find, and Christians test every idea and hold fast to what is true.

Practice: answers

1. Soft, stretchy tissue with tiny branching tubes like blood vessels.
2. An observation: it can be seen and tested.
3. An interpretation: no one saw the dinosaur alive; the date is an explanation.

TRACK 2 BADGE QUIZZES

The badge quizzes are optional. Read each question aloud; the child may answer by talking, pointing or drawing. Four right out of five earns the badge. Badges and the certificate are earned by doing the stops, not by scores.

Badge quiz 1 (Stops B1–B5)

1. What did Mary Anning and her brother find at Lyme Regis?
2. Which dinosaur was the first to get a scientific name?
3. Where was Iguanodon's "horn" really?
4. Who made up the word "dinosaur," and what does it mean?
5. Where did guests eat dinner on New Year's Eve, 1853?

Badge quiz 2 (Stops B6–B10)

6. What sin hurt Cope and Marsh in the Bone Wars?
7. Who found the first T. rex skeleton?
8. Was Oviraptor really an egg thief?
9. Who was SUE named after?
10. What is the difference between an observation and an interpretation?

TRAIL CERTIFICATE: MY DINOSAUR HUNTERS NOTEBOOK AND TRAIL B CERTIFICATE

Gather the Field Notebook pages from this trail into one booklet with a cover: "My Dinosaur Hunters Notebook," your name and the dates you started and finished.

Add a timeline page with the ten discoveries in order, from Mary Anning (1811) to Mary Schweitzer (2005).

Add one "Observe or Interpret?" page from Stop B10.

When the booklet is done, a parent signs the Trail B certificate.

- **Ten stops:** At least one page for each hunter, each with a title and a date.
- **Timeline:** The ten discoveries are in the right order with their years.
- **Observe or interpret:** The child can sort sentences into observations and interpretations.
- **Care:** Drawings are labeled and done carefully.

Answer key

1. An ichthyosaur, a "fish lizard" sea reptile (and later Mary found a plesiosaur).
2. Megalosaurus, named by William Buckland in 1824.
3. On its thumb.
4. Richard Owen (1842); "terrible lizard" or "fearfully great lizard."
5. Inside the mold of Hawkins' Iguanodon model.
6. Envy (and pride).

7. Barnum Brown, in Montana, in 1902.
8. No. It was a parent guarding its own eggs.
9. Sue Hendrickson, who found it.
10. An observation is what we can see or test; an interpretation is an explanation of what it means.

SCHOOL LAUNCH · EXPLORE TRACKS

EXPLORE TRACKS · TRAIL C

The third trail of three interest tracks for curious Scouts: Animals (reptiles and amphibians), Dinosaurs (how dinosaurs lived) and Great Battles of the Age of Sail and the American Founding. Short, self-paced stops with true stories, great pictures, hands-on projects and games.

First edition

O LORD, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches.

Psalms 104:24 (KJV)

COURSE GUIDE

Explore Tracks are for children who want more of what they love. Each track is a trail of short stops. At every stop the child hears a true story, studies a great picture, does something with his or her hands, plays a game and adds a page to a Field Notebook. Each stop also names the School Launch course where the subject goes deeper.

Trail C is the third trail of each track at the  Scout level (ages 7–9). The Animals track meets the reptiles and amphibians, from the crocodile and the Komodo dragon to the frogs, salamanders and the Gila monster of the American desert. The Dinosaurs track asks how dinosaurs lived: what their teeth, eggs, footprints and bones tell us about what they ate, how they raised their young, how fast they moved and what they may have sounded like, and it keeps practicing the difference between what we observe and how it is interpreted. The Great Battles track visits eight battles from the Spanish Armada (1588) to Trafalgar (1805), including five from the French and Indian War and the American War for Independence: Quebec, Lexington and Concord, Trenton, Saratoga and Yorktown. Trails A and B are not required first.

WHO IT IS FOR

Written for children about ages 7–9 who are read to by a parent, or who read short passages on their own. Older siblings can join in. Nothing earlier is required.

HOW TO USE THIS COURSE

1. **One stop at a time.** A stop takes 15–25 minutes: read the story aloud, look at the picture, do the hands-on part and play the game. Two or three stops a week works well.
2. **Any order.** The tracks are independent. Do one track at a time, or rotate between them.
3. **Battle stops.** Each battle has a terrain map to draw, a tabletop activity with blocks or toy figures, and a “Choose your move” puzzle: the child picks the commander’s next step before hearing what really happened.
4. **Field Notebook.** Every stop ends with a page for the notebook. At the end of the trail the pages become a booklet, and the parent signs the Trail C certificate.
5. **Badge quizzes.** Each track has two short, optional oral quizzes. They are for fun, not grades.

SCOPE AND SEQUENCE

Track 2: Dinosaurs  Trail C: How Dinosaurs Lived (Self-paced)

MATERIALS

- **Field Notebook (a sketchbook or composition book)** One for the whole trail.
- **Colored pencils, a ruler, scissors and glue** For drawings and maps.

- **Household things** Each hands-on project lists what it needs: blocks, clay, string, toy figures, cups, a tape measure, sidewalk chalk.
- **A Bible (KJV)** For the verse at each stop.

GRADING

Explore Tracks are not graded. A stop is done when the child has heard the story, done the hands-on part and made a notebook page.

Badges and the Trail C certificate are earned by finishing the stops.

A NOTE TO PARENTS

You do not need to be an expert. Read the story aloud, look at the picture together and ask, “What do you notice?” Each stop has a short *For families* note with background and any facts that scholars still discuss.

Reptiles and amphibians: the stories are for watching, not handling. Some of these animals are venomous or poisonous (the Gila monster, many snakes, poison dart frogs), and pet reptiles and amphibians can carry germs such as Salmonella. Each stop with an outdoor or animal activity has a safety line: look but do not touch wild animals, and wash hands after any contact with a pet reptile or amphibian or its tank.

Dinosaur dates: museums give ages in millions of years. This trail teaches the period names as museum words and explains that the dates are interpretations; many Christian families understand the fossils within a young earth and the Flood. Where a date comes up, a ⏳ box sets out “What the sign says / What we observe / How Christians read it.” The questions in this trail, such as feathers, warm blood and dinosaur sounds, also separate what the fossils actually show from what scientists still debate.

Battles are told for young children: the map, the plan, the people and why it mattered, with honor for courage, faith and wisdom and no gory detail. Casualties are given as numbers, and deaths are stated plainly but not described. Both sides are described fairly, in the terms of their own time: English and Spanish, the defenders of Vienna and the Ottoman army, French and British at Quebec, and the British and the Americans in the War for Independence, including colonists who stayed loyal to the King. Paintings were chosen for composition and story.

CONTENTS

Track 2: Dinosaurs **Trail C: How Dinosaurs Lived**

- 2.1 Teeth Tell Diet
- 2.2 Eggs and Nests
- 2.3 Footprints and Trackways
- 2.4 Herds
- 2.5 How Fast Could They Run?
- 2.6 Were They Warm-Blooded?
- 2.7 Feathers: What the Fossils Show
- 2.8 Babies and Growth
- 2.9 Sauropod Necks
- 2.10 Dinosaur Sounds

Each stop takes 15–25 minutes. Tracks may be done in any order, and a child may do just one track.

DINOSAURS TRAIL C: HOW DINOSAURS LIVED

The third trail of the Dinosaurs track asks how dinosaurs lived: what their teeth tell us about their food, their eggs and nests, the footprints they left in stone, herds, how fast they could run, whether they were warm-blooded, the feathers some of them had, how their babies grew, the long necks of the sauropods and what sounds they may have made. Each stop is a short read-aloud story, a picture to study, something to make, quick questions, a game and a verse of Scripture.

This is the  **Scout** level, for ages 7 to 9. A parent reads the story aloud, or a strong reader reads it alone. Every stop stands by itself. The track is creation-friendly: God made the land animals, dinosaurs among them, on the sixth day (Genesis 1:24-25). Children learn to keep apart what the fossils *show* and what people *think* they mean, and to say plainly when scientists do not yet know.

Five stops earn the **Dinosaur Detective badge, part 1**, and ten stops earn part 2 and the **Trail C certificate**. The badge quizzes are at the end of the trail and are optional.

BEFORE YOU BEGIN

- Listen to a story of about five minutes and tell it back.
- Know what a fossil is (Trail A, or ask a grown-up), and know the six days of creation from Genesis 1.

MASTERY CHECKLIST

- ☐ I can tell from a tooth whether a dinosaur ate meat or plants.
- ☐ I can name three kinds of trace fossils (footprints, eggs, nests) and what each one tells us.
- ☐ I can explain how footprints show whether a dinosaur walked or ran.
- ☐ I can tell the story of Maiasaura, the “good mother lizard,” and how growth rings show a dinosaur’s age.
- ☐ I can tell the difference between what a fossil shows and what people think it means.

OPTIONAL BOOKS AND RESOURCES

- **American Museum of Natural History: OLogy Paleontology** (<https://www.amnh.org/explore/ology/paleontology>): Free children’s pages, games and activities about fossils and dinosaurs.
- **Museum of the Rockies (Bozeman, Montana)** (<https://museumoftherockies.org>): Home of Maiasaura and Egg Mountain finds; photos for Stops C2 and C8.
- **Dinosaur Valley State Park, Texas** (<https://tpwd.texas.gov/state-parks/dinosaur-valley>): Real dinosaur trackways in the Paluxy River (Stops C3 and C5); photos and a free park map online.

2.1 TEETH TELL DIET

OBJECTIVES

- Tell what kind of teeth a meat eater had and what kind a plant eater had.
- Explain how scientists use fossil teeth to learn what a dinosaur ate.
- Say Genesis 1:30 and tell what God first gave animals to eat.

Warm-up. Run your tongue over your own teeth. The ones in front are thin and good for biting. The ones in the back are wide and bumpy, good for grinding. Your teeth tell what you eat: a little of everything! Dinosaur teeth tell stories too.

Video slot. Video coming. Dinosaur teeth for children: T. rex teeth, duck-billed dinosaur tooth batteries, sauropod peg teeth. Search approved channels (American Museum of Natural History, Natural History Museum London, Smithsonian National Museum of Natural History); preview first.

KEY TERMS

diet

The kind of food an animal usually eats.

carnivore

An animal that eats meat (say “CAR-nih-vor”).

herbivore

An animal that eats plants (say “HER-bih-vor”).

serrated

Having tiny bumps along the edge, like a bread knife, for cutting.

CORE IDEAS

The story. A fossil hunter brushes dust from a rock and finds something shiny and dark. It is a tooth, curved like a banana and as long as a grown-up’s hand. Along its edges are tiny bumps, like the edge of a bread knife. The hunter smiles. “This animal ate meat,” she says. How can she tell from just one tooth?

Knife teeth. Meat eaters, or **carnivores**, such as T. rex, had sharp, pointed teeth with **serrated** edges. The tiny bumps helped the teeth cut through meat the way a bread knife cuts through a crust. The biggest T. rex teeth, root and all, were about as long as a ruler. Spinosaurus had smooth, cone-shaped teeth like a crocodile’s, good for holding slippery fish.

Grinding teeth. Plant eaters, or **herbivores**, had very different teeth. Duck-billed dinosaurs had hundreds of small teeth packed together in rows, making a rough grinding surface, like a rasp or a cheese grater. When one tooth wore down, a new one pushed up underneath. Long-necked dinosaurs had teeth like pegs or pencils. They raked leaves off branches and

swallowed them without much chewing. Some grew a new tooth in each spot about once a month!

Clues in the teeth. Scientists look at the shape of a tooth, the scratches on it and how it wore down. Long, straight scratches can mean the animal was grinding tough plants. Sometimes they even find fossil droppings with bits of bone or plants inside. Clue by clue, they learn what a dinosaur ate.

“Every green herb.” The Bible tells us that in the beginning God gave the animals “every green herb for meat,” that is, for food (Genesis 1:30). Many Christians believe that after Adam sinned and the world was cursed, some animals began to eat other animals. The sharp teeth we find show us what a dinosaur ate in the world after the Fall. One day God will make all things new, and “the lion shall eat straw like the ox” (Isaiah 11:7).

PICTURE STUDY



Edmontosaurus (then called Trachodon), Charles R. Knight, 1909 · Painting · Made for the American Museum of Natural History, New York
Wikimedia Commons · Public domain

Charles R. Knight was one of the first great painters of dinosaurs. He painted these duck-billed dinosaurs from two skeletons set up at the American Museum of Natural History. Behind their flat “duck bills,” these dinosaurs had hundreds of grinding teeth.

Look closely

- Find the wide, flat beak at the front of the mouth.
- Look at the land around the dinosaurs. What plants can you see that they might eat?
- Find the dinosaur standing tall. What do you think it is looking at?

Talk about it

1. The beak did not have teeth in it. Where do you think the grinding teeth were?
2. Would this dinosaur want to eat the plants, or the other animals? How can you tell?

HANDS-ON: CLAY TOOTH DETECTIVE

Make three kinds of dinosaur teeth from clay and decide what each one was made to eat.

You will need

- Modeling clay or play dough
- A toothpick
- A plastic knife
- A lettuce leaf

Steps

1. Make a **knife tooth**: roll a long, curved, pointed tooth. Press the toothpick along both edges to make tiny serrations.
2. Make a **grinding tooth**: press several small square teeth side by side into a flat clay pad. Scratch the top so it is rough.
3. Make **peg teeth**: roll five thin pencil shapes and stand them in a row like a comb.
4. Pull the lettuce leaf through the peg teeth. What happens to the leaf? Rub a bit of leaf on the grinding pad. Which tooth would be best for cutting meat?

Check your work

- I made a knife tooth, a grinding pad and peg teeth.
- I can tell which tooth belonged to a carnivore and which to a herbivore.
- I can say what “serrated” means.

FIELD NOTEBOOK

1. Draw three dinosaur teeth: a knife tooth, a grinding tooth and a peg tooth. Under each, write “meat” or “plants.”
2. Copy Genesis 1:30 in your best handwriting.

Did you know? Dinosaurs kept growing new teeth all their lives, so a single dinosaur might lose hundreds of teeth. That is why fossil teeth are some of the most common dinosaur fossils. Gideon Mantell named *Iguanodon* (“iguana tooth”) because its fossil teeth looked like giant iguana teeth.

Goes deeper in. Life Science, the animals and food chains units (coming soon); and Earth Science, for fossils.

For families. The largest *T. rex* teeth measure about 12 inches (30 cm) including the root. Tooth-replacement rates come from studies of growth lines in teeth (D’Emic and others, 2013): *Diplodocus* replaced each tooth roughly every month, and *Nigersaurus*

about every two weeks. Hadrosaur “dental batteries” held hundreds of teeth. The view that animal death and meat eating began after the Fall is widely held by young-earth Christians; other Christians read Genesis 1:30 differently. The stop states the young-earth reading as the course’s position without mocking other views.

PRACTICE

1. **EASY** What is a carnivore? What is a herbivore?
2. **MEDIUM** You find a sharp, curved tooth with tiny bumps on its edges. What did the animal probably eat?
3. **MEDIUM** Why did duck-billed dinosaurs have so many teeth?

Make it a game · Who Ate What?. A grown-up names a food: a fish, a pine branch, a big animal, a fern, a leaf high in a tree. Players show a tooth with their hands: a pointed finger for a knife tooth, a flat palm for grinding teeth, or wiggling fingers for peg teeth. Then talk about which dinosaur might have eaten it.

Scripture. “And to every beast of the earth, and to every fowl of the air, and to every thing that creepeth upon the earth, wherein there is life, I have given every green herb for meat: and it was so.” (Genesis 1:30, KJV)

“Meat” in the King James Bible means food. In the beginning God gave plants to the animals to eat. God takes care of every creature He made.

Practice: answers

1. A carnivore eats meat; a herbivore eats plants.
2. Meat. Sharp, serrated teeth are for cutting meat.
3. They ground up tough plants, and new teeth kept replacing the worn ones.

2.2 EGGS AND NESTS

OBJECTIVES

- Tell how dinosaur eggs were like bird eggs.
- Describe two kinds of dinosaur nests: eggs buried in the ground and eggs kept warm by a parent.
- Tell the story of the fossil parent found sitting on its nest.

Warm-up. Hold a chicken egg gently in your hand. Feel how smooth and hard the shell is. Now guess: how big was the egg of the biggest dinosaur? Bigger than a basketball? Smaller? Hold that guess until the end of the story!

Video slot. Video coming. Dinosaur eggs and nests for children: the brooding Citipati, titanosaur eggs from Argentina, Maiasaura nests. Search approved channels (American Museum of Natural History, Natural History Museum London, Museum of the Rockies); preview first.

KEY TERMS

shell

The hard outside of an egg that protects the baby growing inside.

nest

A place an animal makes to lay its eggs and keep them safe.

embryo

A baby animal still growing inside its egg (say “EM-bree-oh”).

brood

To sit on eggs and keep them warm, as a hen does.

CORE IDEAS

The story. In 1993, a team of fossil hunters was working in the hot, windy Gobi Desert of Mongolia. One of them spotted a dark shape in the red sand. Carefully they brushed it clean. It was a dinosaur skeleton, crouched down with its arms spread wide, sitting right on top of a ring of eggs! The parent had been covering its nest when it was buried.

Eggs like a bird’s. Every dinosaur we know of hatched from an egg with a hard **shell**, like a bird’s egg. Some were round like a ball and some were long like a potato. Here is the answer to the warm-up: even the eggs of the giant long-necked dinosaurs were only about the size of a grapefruit. A small egg can hatch a baby that grows very big!

Buried nests. In Argentina, scientists found a huge nesting ground with thousands of round eggs from long-necked dinosaurs. Some eggs still had tiny **embryos** inside, with bits of baby skin showing little bumpy scales. These big dinosaurs probably dug holes, laid their eggs and

covered them with dirt or plants. The warm ground kept the eggs cozy, the way some turtles and crocodiles warm their eggs today.

Sitting nests. The parent found in the Gobi was a **Citipati** (say “CHIT-ih-PAH-tee”), a feathered dinosaur about the size of an ostrich. Its eggs were laid in pairs, in a circle, with the open middle where the parent sat. It was **brooding**, keeping the eggs warm and safe like a mother hen. This showed that some dinosaurs took care of their eggs.

God cares for little ones. Some animals watch over their eggs, and some, like the ostrich in Job 39, leave them in the warm dust. Either way, God made each creature to bring new life into the world, and He knows every egg and every nest.

PICTURE STUDY



Bird's Nest with Sprays of Apple Blossoms, William Henry Hunt, Mid-1800s · Watercolor · Yale Center for British Art, New Haven, Connecticut
Wikimedia Commons · CC0

William Henry Hunt, an English painter, painted so many birds' nests that people nicknamed him “Bird’s Nest Hunt.” No one has ever seen a living dinosaur nest, but a bird’s nest helps us picture how some dinosaurs cared for their eggs.

Look closely

- Count the eggs in the nest. What colors are they?
- Look at what the nest is made of. Can you find moss, twigs or grass?
- Find the flowers. What season do you think it is?

Talk about it

1. How is this nest like the Citipati nest in the story? How is it different?

2. Why do you think the artist painted the eggs so carefully?

HANDS-ON: A DINOSAUR NEST

Build two kinds of dinosaur nests: a buried nest and a brooding nest.

You will need

- Play dough or salt dough for eggs
- A shoebox lid or tray of sand or dirt
- Leaves or grass
- A toy dinosaur or bird (or a paper one)

Steps

1. Roll ten small eggs. Make five round, like long-necked dinosaur eggs, and five long, like Citipati eggs.
2. **Buried nest:** scoop a hole in one end of the tray, set the round eggs in it, and cover them with sand and leaves.
3. **Brooding nest:** set the long eggs in pairs in a circle at the other end, leaving an open space in the middle. Set your toy in the middle with its arms spread over the eggs.
4. Tell a grown-up which nest keeps eggs warm by the ground and which keeps eggs warm by a parent.

Check your work

- I made a buried nest and a brooding nest.
- My Citipati eggs are in pairs, in a circle.
- I can tell what “brood” means.

FIELD NOTEBOOK

1. Draw a Citipati sitting on its ring of eggs, with its feathered arms spread wide. Label the eggs and the parent.
2. Draw a chicken egg and a grapefruit-sized dinosaur egg side by side. Write: “Big dinosaurs, small eggs.”

Did you know? The first dinosaur eggs known to science were found in the Gobi Desert in 1923 by a team led by Roy Chapman Andrews (Trail B, Stop B8). For many years people thought those eggs belonged to a horned dinosaur, and that a dinosaur found nearby had come to steal them. The parent found sitting on its nest in 1993 helped show that this kind of dinosaur was guarding its own eggs.

Goes deeper in. Life Science, the animals and life cycles units (coming soon); and Gardening & Animals, for birds, nests and eggs.

For families. The brooding Citipati (specimen IGM 100/979, nicknamed “Big Mama”) was found in 1993 at Ukhaa Tolgod, Mongolia, by an American Museum of Natural History and Mongolian Academy of Sciences team and reported by Norell and others in *Nature* (1995). The titanosaur nesting ground at Auca Mahuevo, Argentina, was found in 1997; some eggs held embryos with skin impressions (Chiappe and others, 1998). Titanosaur eggs there are roughly 5–6 inches (13–15 cm) across. A few elongated eggs from large feathered dinosaurs were longer, up to about 18 inches, so “grapefruit-sized” describes the long-necked dinosaurs, not every kind.

PRACTICE

1. **EASY** How were dinosaur eggs like bird eggs?
2. **MEDIUM** What did fossil hunters find in the Gobi Desert in 1993?
3. **MEDIUM** How did the long-necked dinosaurs probably keep their eggs warm?

Make it a game • Guard the Nest. One player is the Citipati and crouches over three “eggs” (balled-up socks) with arms spread wide. The others tiptoe close and try to touch an egg. If the Citipati tags a player, that player freezes for three seconds. Take turns being the parent.

Scripture. “Which leaveth her eggs in the earth, and warmeth them in dust,” (Job 39:14, KJV)

God asked Job about the ostrich, who lays her eggs in the warm ground. God knows how every creature cares for its eggs, even ones Job had never thought about.

Practice: answers

1. They had hard shells.
2. A Citipati skeleton sitting on its nest of eggs, with its arms spread over them.
3. They buried them in the ground under dirt or plants.

2.3 FOOTPRINTS AND TRACKWAYS

OBJECTIVES

- Tell the story of the footprints Pliny Moody found in Massachusetts.
- Explain what a trackway can tell us that a bone cannot.
- Make a footprint and a plaster cast of it.

Warm-up. Walk across damp sand, soft dirt or a floury cookie sheet in your bare feet (a grown-up can help). Look back at your prints. Can someone else tell whether you walked or ran? Which way you went? Footprints tell stories!

Video slot. Video coming. Dinosaur footprints and trackways for children: Dinosaur Valley State Park, Texas; Dinosaur State Park, Connecticut; the Amherst College footprint collection. Search approved channels (Texas Parks and Wildlife, Connecticut state parks, Smithsonian National Museum of Natural History); preview first.

KEY TERMS

footprint

The mark a foot leaves pressed into soft ground.

trackway

A line of footprints made by one animal walking or running.

trace fossil

A fossil that shows something an animal did, such as a footprint, a nest or a burrow, instead of a part of its body.

cast

A copy made by pouring something soft into a mold and letting it harden.

CORE IDEAS

The story. In 1802, a farm boy named Pliny Moody was plowing a field in South Hadley, Massachusetts, when his plow turned up a slab of stone. On it were big, three-toed footprints, like giant bird tracks. The family set the stone by their door as a doorstep. Some people joked that the prints were made by “Noah’s raven,” the bird Noah sent out from the Ark.

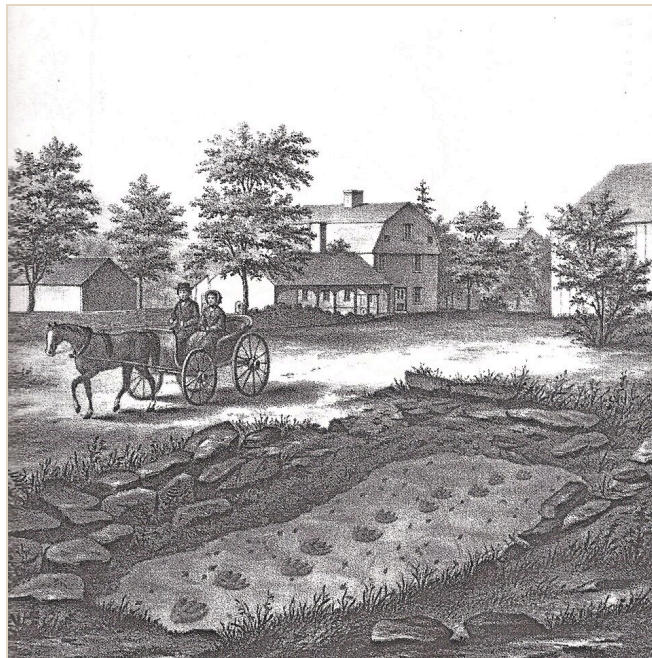
A minister reads the tracks. Years later, a pastor and scientist named Edward Hitchcock began collecting these stone footprints along the Connecticut River. He gathered thousands of them! Hitchcock thought they were made by giant birds. Today scientists think most were made by dinosaurs with three-toed feet much like a bird’s. Hitchcock’s great collection is still at Amherst College.

What tracks tell. A footprint is a **trace fossil**. It does not show the animal's body; it shows what the animal *did*. A **trackway**, a line of prints, tells even more. Did the animal walk on two legs or four? Was it walking slowly or running? Was it alone or with others? Did its tail drag on the ground? (Almost never!)

Tracks in Texas. In 1938, a fossil hunter named Roland T. Bird followed giant footprints along the Paluxy River in Texas. He found the round prints of a huge long-necked dinosaur and, right beside them, the three-toed prints of a meat eater. Was the meat eater following it? People still wonder.

Quickly covered. A footprint in mud is gone after the next rain. For a track to last, it had to be covered quickly with more mud or sand that later turned to stone. Many Christian geologists think the great Flood of Noah's day explains why so many tracks were covered so fast. Every footprint is a true story of a real animal God made, walking on a real day.

PICTURE STUDY



*The Moody Footmark Quarry, South Hadley, Edward Hitchcock, 1858 · Printed drawing (from Hitchcock's book *Ichnology of New England*) · From *Ichnology of New England* (Boston, 1858)*
Wikimedia Commons · Public domain

This picture comes from Edward Hitchcock's big book about the stone footprints of New England. It shows the quarry on the Moody farm, near where Pliny Moody first plowed up a slab of tracks. Hitchcock used the word "ichnology," which means "the study of tracks."

Look closely

- Find the flat layers of rock. Where do you think the footprints were?
- Look for people or tools. How big is the quarry compared to them?
- Look at the trees and the land around it. Does this look like a farm?

Talk about it

1. Why would a scientist want to draw a picture of the place where the tracks were found?
2. If you found a slab of footprints on your farm, what would you do with it?

Safety first. A grown-up mixes the plaster. Plaster gets warm as it hardens; do not put hands or feet into wet plaster, and do not pour leftover plaster down the drain.

HANDS-ON: MAKE A FOSSIL TRACK

Press a footprint into clay and make a plaster cast, just as scientists copy fossil tracks.

You will need

- A ball of modeling clay or play dough, flattened to about an inch thick
- A toy dinosaur, or your fingers
- A strip of cardboard and tape
- Plaster of Paris, water, a paper cup and a craft stick (with a grown-up)

Steps

1. Press the toy dinosaur's foot deep into the clay. Or press three fingers in to make a three-toed track.
2. Wrap the strip of cardboard around the track like a fence and tape it.
3. A grown-up mixes plaster with water until it is like thick pancake batter. Pour it into the fence to about an inch deep.
4. Wait about an hour, then peel away the clay. Your cast shows the foot that made the print!

Check your work

- I made a clear footprint in clay.
- I made a plaster cast of my footprint.
- I can tell what a trace fossil is.

FIELD NOTEBOOK

1. Draw a trackway of six three-toed prints in a line. Draw arrows to show which way the dinosaur was going.
2. Write: "A footprint shows what an animal did."

Did you know? You can still see dinosaur tracks in the riverbed at Dinosaur Valley State Park in Glen Rose, Texas, when the water is low. In Connecticut, workers digging for a building in 1966 uncovered hundreds of tracks, and Dinosaur State Park was built over them so people could see them.

Goes deeper in. Earth Science, the fossils and rock layers units (coming soon); and History, for New England in the 1800s.

For families. Pliny Moody's find is usually dated to 1802; the "Noah's raven" nickname is reported in histories of the find. Edward Hitchcock (1793–1864), a Congregational minister and president of Amherst College, published *Ichnology of New England* in 1858; his collection is at the Beneski Museum of Natural History, Amherst College. Roland T. Bird excavated the Paluxy River trackways in 1938 for the American Museum of Natural History. Tracks must be buried rapidly to be preserved; the link to the Flood is the young-earth reading, and mainstream geologists explain the same tracks by local floods and tides over long ages. Plaster gets warm as it sets; do not set it on skin. Keep plaster out of the sink.

PRACTICE

1. **EASY** What did Pliny Moody find while plowing?
2. **MEDIUM** Name two things a trackway can tell us that a bone cannot.
3. **EASY** Why is a footprint called a trace fossil?

Make it a game • Track Detective. One player walks, hops, tiptoes or runs across damp sand, snow or a sheet of paper with chalky feet while the others look away. The others study the tracks and guess how the player moved. Then switch.

Scripture. "Thy way is in the sea, and thy path in the great waters, and thy footsteps are not known." (Psalm 77:19, KJV)

We can follow a dinosaur's footprints in stone, but we cannot track God the same way. He is greater than we can see, yet the next verse says He led His people "like a flock."

Practice: answers

1. A stone slab with big three-toed footprints.
2. Any two: whether the animal walked or ran, on two legs or four, alone or with others, which way it went, whether its tail dragged.
3. Because it shows something the animal did, not a part of its body.

2.4 HERDS

OBJECTIVES

- Name two kinds of clues that some dinosaurs lived in herds.
- Tell two ways a herd helps keep animals safe.
- Say Ecclesiastes 4:12 and tell what it means for a family.

Warm-up. Think of animals that live in groups today: cows, sheep, zebras, elephants, geese. Why do you think they stay together? Make a list with a grown-up before you read the story.

Video slot. Video coming. Did dinosaurs live in herds? Trackways of many dinosaurs walking together and bonebeds of horned dinosaurs, for children. Search approved channels (American Museum of Natural History, Royal Tyrrell Museum, Natural History Museum London); preview first.

KEY TERMS

herd

A large group of animals of one kind that live and travel together.

bonebed

A layer of rock packed with the bones of many animals buried together.

parallel

Going the same way side by side, like the two rails of a train track.

predator

An animal that hunts other animals for food.

CORE IDEAS

The story. In Texas, on a ranch called Davenport Ranch, Roland T. Bird mapped a wide rock covered with giant round footprints. They were not just one trackway. More than twenty long-necked dinosaurs had walked across the mud, side by side, all going the same way. It looked like a herd on the move!

Clue one: trackways. When many trackways run **parallel**, all heading the same way at the same time, it is a clue that the animals were traveling together. Roland Bird thought the little ones walked in the middle of the group, with the big ones around them. Later scientists are not so sure. Even good scientists sometimes read the same tracks in different ways.

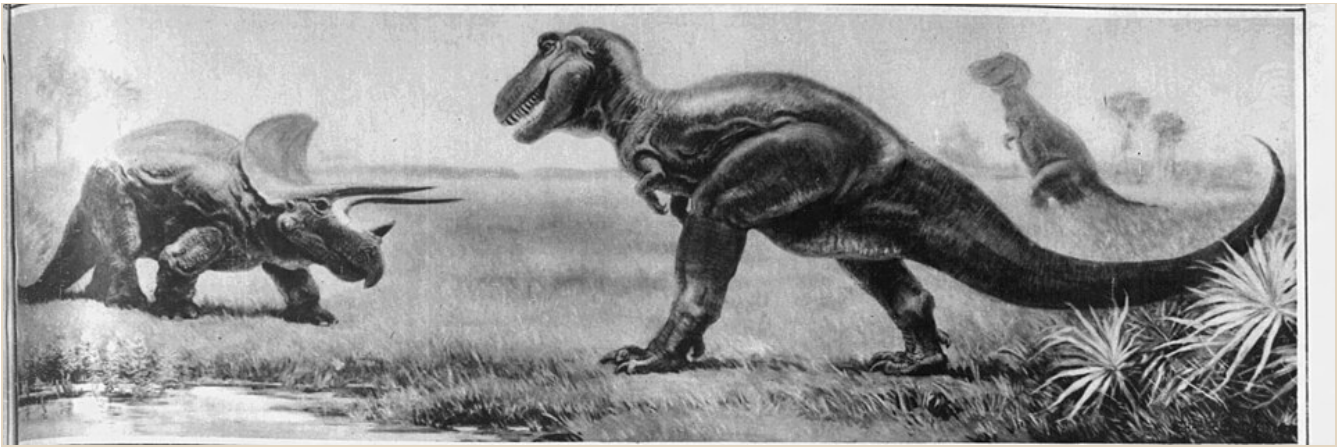
Clue two: bonebeds. In Alberta, Canada, scientists have found **bonebeds** with the bones of thousands of horned dinosaurs called Centrosaurus, buried all together, young and old. In Montana there is a huge bonebed of duck-billed Maiasaura. So many animals of one kind in

one place is a strong clue that they lived in groups, and that something buried them all at once, perhaps a great flood.

Why live in a herd? A herd has many eyes and ears. If one animal sees a **predator**, like a T. rex, all of them can run or stand together. Horned dinosaurs may have faced outward in a ring, horns pointed at the enemy, the way musk oxen do today. A herd can also travel together to find food and water.

Together is stronger. God made many creatures to live together, and He made people to live in families and churches. The Bible says, “A threefold cord is not quickly broken” (Ecclesiastes 4:12). One string snaps easily; three strings twisted together hold strong.

PICTURE STUDY



Tyrannosaurus and Triceratops (Field Museum mural), Charles R. Knight, 1928 · Oil painting (mural) · Field Museum, Chicago
Wikimedia Commons · Public domain

Charles R. Knight painted a whole set of large murals of ancient animals for the Field Museum in Chicago between 1926 and 1930. This one is the most famous of them all: a meat eater meets a horned plant eater. Knight wanted visitors to feel as if they were standing right there.

Look closely

- Find the Triceratops. Are there any more animals behind it, far away?
- Look at the Triceratops's head. Which way are its horns pointing?
- Look at the T. rex. Is it running or standing still?

Talk about it

1. If Triceratops lived in a herd, how might the others help the one in front?
2. What do you think happens next? Tell the story.

HANDS-ON: HERD TRACKWAY MAP

Make a map of a herd's trackways, like Roland Bird's map in Texas.

You will need

- A long sheet of paper (taped-together paper or the back of wrapping paper)
- A big sponge or potato cut in a round shape, and a small one (with a grown-up)
- Washable paint on a paper plate
- A pencil

Steps

1. Dip the big round stamp in paint. Stamp a line of footprints from one end of the paper to the other: left, right, left, right.
2. Stamp four or five more big trackways side by side, all going the same way. These are the grown-ups.
3. With the small stamp, add two or three small trackways. Where will you put the young ones?
4. Draw an arrow showing the way the herd was going. Tell a grown-up why you put the young ones where you did.

Check your work

- My trackways are parallel and go the same way.
- I added small trackways for young dinosaurs.
- I can name two clues that dinosaurs lived in herds.

FIELD NOTEBOOK

1. Draw a ring of horned dinosaurs facing outward with their horns pointed at a predator. Put a young one in the middle.
2. Write: "Trackways and bonebeds are clues to herds."

Did you know? Some fossil hunters have found trackways of a few meat eaters walking side by side too. Whether meat eaters hunted together like wolves is still being studied. The clues are good for plant eaters such as horned dinosaurs, duckbills and long-necked dinosaurs.

Goes deeper in. Life Science, the animals and ecosystems units (coming soon); and Gardening & Animals, for herds of cattle and sheep.

For families. Roland T. Bird mapped the Davenport Ranch sauropod trackways in Medina County, Texas, around 1940; they record more than twenty individuals moving in one direction (later studied by John Ostrom and others). Bird's idea that juveniles walked inside the group has been questioned. Centrosaurus bonebeds in Alberta, including the

Hilda mega-bonebed, contain remains of many hundreds to thousands of animals; the Maiasaura bonebed in Montana is estimated at thousands of animals. Mainstream geologists attribute such bonebeds to local floods or droughts; many creation geologists see them as evidence of catastrophic burial in the Flood. Both agree many animals were buried together. Knight's Field Museum murals date from 1926 to 1930; this one was publicized in 1928.

PRACTICE

1. **EASY** What is a herd?
2. **MEDIUM** Name two clues that some dinosaurs lived in herds.
3. **MEDIUM** How does living in a herd help keep animals safe?

Make it a game • Herd and Hunter. One player is the T. rex. The rest are a herd of Triceratops holding hands in a ring around a “baby” (a stuffed animal). The T. rex walks around the outside and tries to tag the baby; the herd turns and moves to keep the T. rex out. Play gently and walk, do not run. Switch roles.

Scripture. “And if one prevail against him, two shall withstand him; and a threefold cord is not quickly broken.” (Ecclesiastes 4:12, KJV)

One alone can be beaten, but two or three together stand strong. God gives us families and friends so we do not have to stand alone.

Practice: answers

1. A large group of animals of one kind that live and travel together.
2. Parallel trackways going the same way, and bonebeds with many dinosaurs of one kind buried together.
3. Many eyes and ears watch for danger, and the animals can stand or run together against a predator.

2.5 HOW FAST COULD THEY RUN?

OBJECTIVES

- Explain how footprints help scientists guess a dinosaur's speed.
- Compare walking steps and running steps by measuring your own.
- Name a fast kind of dinosaur and tell why T. rex was probably not a fast runner.

Warm-up. Walk ten steps across the yard. Then run ten steps. Did you go farther when you ran? Why? Keep that in mind: it is the secret scientists use to measure dinosaur speed.

Video slot. Video coming. How fast could dinosaurs run? Measuring speed from trackways; ostrich-like dinosaurs; T. rex speed, for children. Search approved channels (American Museum of Natural History, Natural History Museum London, Royal Veterinary College); preview first.

KEY TERMS

speed

How fast something moves.

stride

The distance from one footprint to the next print of the same foot.

hip height

How tall an animal is from the ground to the top of its leg at the hip.

ostrich dinosaur

A light, long-legged dinosaur shaped a lot like an ostrich, such as *Struthiomimus* ("ostrich mimic").

CORE IDEAS

The story. No one has ever timed a dinosaur with a stopwatch. So how can we know how fast they ran? A scientist named R. McNeill Alexander, who studied how animals move, had an idea. He watched people, horses and ostriches walking and running and measured their footprints. The faster an animal goes, the farther apart its footprints are.

Steps in stone. Here is the secret. Long legs take long steps, and running steps are longer still. If scientists know how long a dinosaur's legs were (its **hip height**) and how far apart its footprints are (its **stride**), they can figure out about how fast it was going. Most dinosaur trackways show animals walking along at an easy pace, like you on a walk to the park.

The fast ones. A few trackways show dinosaurs moving fast. One set of three-toed tracks in Texas may show a meat eater running about as fast as a bicycle racing downhill. The fastest

dinosaurs were probably the light **ostrich dinosaurs**, with long thin legs, big eyes and no teeth. They look built for speed, like the ostrich, the fastest runner on two legs today.

Was T. rex fast? In movies, T. rex chases cars. But a grown T. rex weighed as much as an elephant or more. Scientists have used computers to test how its leg bones and muscles worked. Most think a grown T. rex could walk fast but could not really run; maybe it went about as fast as a strong man running. Young T. rexes, with longer, thinner legs for their size, were probably faster.

Run the race. God made some creatures for speed and some for strength. The Bible says we should “run with patience the race that is set before us” (Hebrews 12:1). Our race is the Christian life. We do not have to be the fastest, but we keep going, step by step, looking to Jesus.

PICTURE STUDY



Leaping Laelaps, Charles R. Knight, 1897 · Watercolor · American Museum of Natural History, New York
Wikimedia Commons · Public domain

When Charles R. Knight painted this in 1897, most people pictured dinosaurs as slow, dragging lizards. Knight, guided by the scientist Edward Drinker Cope, showed them leaping and moving fast. The dinosaur is now called *Dryptosaurus*. Many scientists today think Knight was right that meat eaters like this were quick and lively.

Look closely

- Find the dinosaur in the air. Where are its feet? Where is its tail?
- Look at the dinosaur on the ground. What is it doing?
- Look at the background. Is it daytime? Where are they?

Talk about it

1. How did Knight make this picture look full of motion?
2. Could a big dinosaur really leap like this? What clues would you look for to find out?

HANDS-ON: MEASURE YOUR STRIDE

Use your own footprints to see how stride changes with speed, the way scientists study dinosaur trackways.

You will need

- Sidewalk chalk, or damp sand
- A tape measure
- A pencil and your Field Notebook

Steps

1. Measure your hip height: from the floor to the top of your leg. Write it down.
2. Wet the bottoms of your shoes (or walk barefoot in damp sand). **Walk** across a sidewalk. A grown-up marks where your right foot landed twice in a row. Measure that stride.
3. Now **run** across the same place. Mark and measure your running stride.
4. Compare: how many times longer than your hip height is your walking stride? Your running stride?

Check your work

- I measured my hip height, my walking stride and my running stride.
- I found that my running stride was longer.
- I can tell how footprints show whether a dinosaur was walking or running.

FIELD NOTEBOOK

1. Draw two trackways: one with prints close together (walking) and one with prints far apart (running). Label them.
2. Draw an ostrich dinosaur next to a T. rex. Under each, write “fast” or “slow.”

Did you know? An ostrich can run about 40 miles an hour, faster than a racehorse over a short dash. The ostrich dinosaurs looked so much like ostriches that one was named *Struthiomimus*, “ostrich mimic,” and another *Gallimimus*, “chicken mimic.”

Goes deeper in. Arithmetic, for measuring and comparing lengths; and Life Science, for bones, muscles and how animals move (coming soon).

For families. R. McNeill Alexander published his method for estimating dinosaur speed from stride length and hip height in *Nature* (1976). Speeds from trackways are estimates;

the fast Texas theropod trackway was estimated by James Farlow (1981) at roughly 25 miles an hour (about 40 km/h). Biomechanical studies (Hutchinson and Garcia, *Nature* 2002; Sellers and others, 2017) concluded that adult T. rex could not run fast; estimates are around 10–15 miles an hour or less. Ostrich-dinosaur speeds are inferred from body shape, not trackways, and are uncertain. Laelaps was Cope’s name; the genus was renamed Dryptosaurus by Marsh in 1877 because “Laelaps” was already in use.

PRACTICE

1. **EASY** When you run, are your footprints closer together or farther apart than when you walk?
2. **MEDIUM** What two things do scientists measure to guess how fast a dinosaur moved?
3. **MEDIUM** Which were probably faster: ostrich dinosaurs or a grown T. rex? Why?

Make it a game • Dinosaur Relay. Mark a start and finish line. Players race as different dinosaurs: a long-necked dinosaur (slow, giant steps), a T. rex (fast walk, no running), an ostrich dinosaur (run!) and a Stegosaurus (slow, on hands and feet). Who reaches the finish first? Who would win in real life?

Scripture. “Wherefore seeing we also are compassed about with so great a cloud of witnesses, let us lay aside every weight, and the sin which doth so easily beset us, and let us run with patience the race that is set before us,” (Hebrews 12:1, KJV)

A runner drops anything heavy that would slow him down. Christians lay aside sin and keep going in God’s race with patience, step by step.

Practice: answers

1. Farther apart.
2. How long its legs were (hip height) and how far apart its footprints were (stride).
3. Ostrich dinosaurs. They were light, with long thin legs; a grown T. rex was very heavy.

2.6 WERE THEY WARM-BLOODED?

OBJECTIVES

- Tell the difference between a warm-blooded and a cold-blooded animal.
- Name two clues scientists use to ask whether dinosaurs were warm-blooded.
- Test why a big body stays warm longer than a small one.

Warm-up. Put your hand on your neck or your cheek. You feel warm, even if the room is cool. Your body makes its own heat! A lizard cannot do that. It has to lie in the sun to warm up. Which kind were the dinosaurs?

Video slot. Video coming. Warm-blooded or cold-blooded dinosaurs, for children: lizards basking in the sun, birds and mammals, bone growth. Search approved channels (American Museum of Natural History, Natural History Museum London, Smithsonian National Museum of Natural History); preview first.

KEY TERMS

warm-blooded

Able to make its own body heat and stay warm inside, like birds, dogs and people.

cold-blooded

Getting its warmth from outside, from the sun or warm rocks, like lizards, snakes and turtles.

bask

To lie in the sun to soak up its warmth.

growth rings

Lines inside a bone (or a tree) that show how it grew, like rings in a tree stump.

CORE IDEAS

The story. On a cool morning a lizard creeps out onto a rock. It is slow and stiff. It lies still in the sun, and slowly it warms up. By noon it is darting about, quick as a flash. Near the rock, a robin hops about, busy from the first light of dawn. The robin did not need the sun to warm up. Its own body made the heat.

Two ways to stay warm. Animals like the lizard are called **cold-blooded**. Their blood is not really cold; they just get their warmth from outside, so they **bask** in the sun. Animals like the robin, a dog or you are **warm-blooded**. They burn food inside to make heat, like a little furnace. That is why warm-blooded animals need to eat much more food.

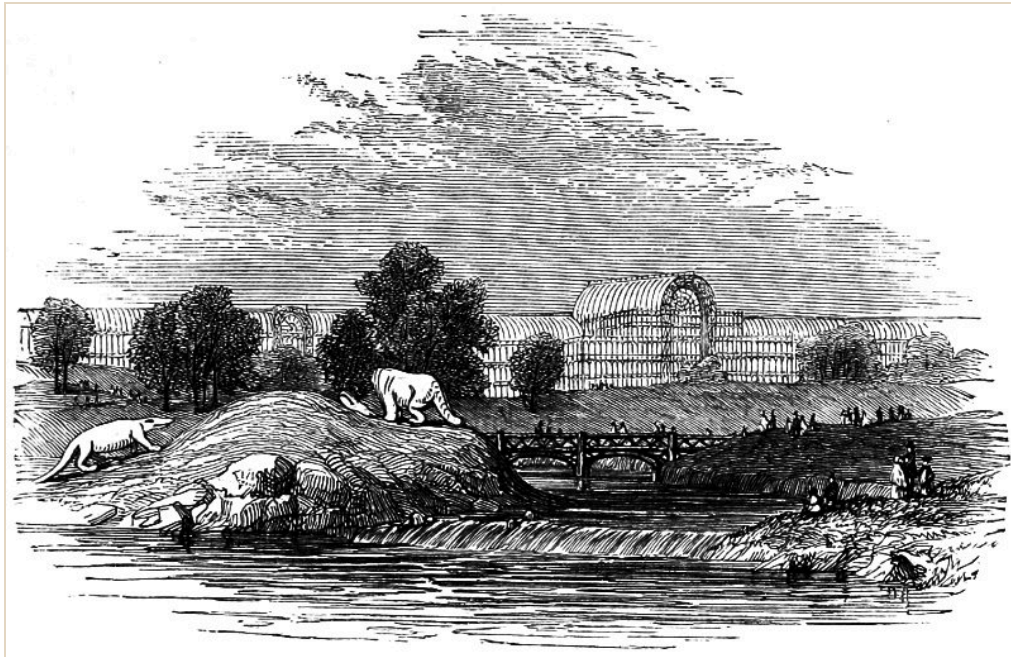
First guesses. Dinosaurs are reptiles, and most reptiles today are cold-blooded, so for a long time people pictured dinosaurs as big, slow lizards. But Richard Owen, who gave dinosaurs their name, thought they were more like big mammals, such as elephants and

rhinoceroses. The sculptor Benjamin Waterhouse Hawkins built them that way at the Crystal Palace in London.

Clues from fossils. Scientists look at many clues. Many dinosaurs stood with their legs straight under them, like a horse, not sprawled out like a lizard. Some had feathers, which help keep a body warm. Their bones show **growth rings** and patterns that tell us many grew very fast, the way warm-blooded animals do. And dinosaur bones have been found in the far north of Alaska, where it is cold and dark much of the year.

Still asking. Many scientists now think many dinosaurs were warm-blooded or somewhere in between. Giant ones may also have stayed warm just by being big, the way a big pot of soup stays hot longer than a small cup. Scientists keep testing. God, who made cold and heat (Genesis 8:22), made each creature just right for its life.

PICTURE STUDY



*The Crystal Palace models, from Owen's guidebook, Benjamin Waterhouse Hawkins (models), with Richard Owen, 1854 · Printed illustration · From *Geology and Inhabitants of the Ancient World* (London, 1854)*
Wikimedia Commons · Public domain

In 1854, Benjamin Waterhouse Hawkins finished life-size models of ancient animals for a park around the Crystal Palace in London, with Richard Owen as his adviser. This picture comes from the guidebook sold to visitors. Hawkins and Owen made the dinosaurs look like heavy, four-legged animals, more like a rhinoceros than a lizard. The models still stand in the park today.

Look closely

- Find an animal standing on four thick legs. Does it look more like a lizard or like an elephant?

- Find the water. Which animals are near it?
- Look at the legs. Are they straight under the body or sprawled out to the sides?

Talk about it

1. Why do you think Owen wanted his dinosaurs to look like big mammals instead of lizards?
2. We now know some of these animals walked on two legs. Is it wrong for scientists to change their pictures when they learn more?

Safety first. Use warm tap water only, not boiling water. A grown-up fills the containers.

HANDS-ON: BIG POT, SMALL CUP

Test whether a big body stays warm longer than a small one.

You will need

- A big jar or pot and a small cup
- Warm tap water (a grown-up fills them)
- A kitchen thermometer, or your finger
- A clock or timer

Steps

1. A grown-up fills the big jar and the small cup with the same warm tap water.
2. Feel the water in each (or read the thermometer). They should feel the same.
3. Wait twenty minutes. Feel or measure each again.
4. Which one cooled faster? Talk about it: how might a giant long-necked dinosaur stay warm even without making much heat?

Check your work

- I compared the big jar and the small cup after twenty minutes.
- I found that the small cup cooled faster.
- I can tell the difference between warm-blooded and cold-blooded.

FIELD NOTEBOOK

1. Make two columns: “Warm-blooded” and “Cold-blooded.” Draw two animals in each.
2. Draw a dinosaur and write one clue that it might have been warm-blooded.

Did you know? A hummingbird is warm-blooded and so tiny that it must eat many times its body weight in nectar and bugs each day. A crocodile is cold-blooded and can go months without a meal. Making your own heat takes a lot of food!

Goes deeper in. Life Science, the animals and body systems units (coming soon); and Trail B, Stop B5 on the Crystal Palace dinosaurs.

For families. Richard Owen argued in his 1842 report that dinosaurs were advanced reptiles with features suggesting a more mammal-like body plan; how far he thought they were “warm” is debated, so the stop says only that he pictured them like large mammals. The modern warm-blooded debate grew from the work of John Ostrom and Robert Bakker in the late 1960s and 1970s. Evidence includes fast-growing bone tissue, upright posture, feathers in some groups and dinosaur fossils (including juveniles) from northern Alaska. Some studies suggest many dinosaurs were “in between” (Grady and others, *Science* 2014); the question is open. “Warm-blooded” and “cold-blooded” are everyday words for endotherm and ectotherm.

PRACTICE

1. **EASY** Why does a lizard lie in the sun?
2. **MEDIUM** Why do warm-blooded animals need to eat more food?
3. **MEDIUM** Name two clues that some dinosaurs may have been warm-blooded.

Make it a game • Sun and Shade. Players are lizards. When the leader calls “Sun!”, lizards move fast. When the leader calls “Shade!”, lizards move very slowly. When the leader calls “Robin!”, everyone moves quickly no matter what, because birds make their own heat. Anyone who moves at the wrong speed becomes the next leader.

Scripture. “While the earth remaineth, seedtime and harvest, and cold and heat, and summer and winter, and day and night shall not cease.” (Genesis 8:22, KJV)

God promised Noah that cold and heat, summer and winter would keep coming. He made animals with different ways to live through them.

Practice: answers

1. To warm up. It is cold-blooded and gets its heat from outside.
2. They burn food inside their bodies to make their own heat.
3. Any two: legs straight under the body, feathers, bones that show fast growth, fossils found in cold northern places.

2.7 FEATHERS: WHAT THE FOSSILS SHOW

OBJECTIVES

- Tell the story of Archaeopteryx and its feathers in stone.
- Describe what was found on some small dinosaurs from China.
- Keep apart what the fossils show (observation) and what people think it means (interpretation).

Warm-up. Hold a feather (from a craft store or a pillow) and look closely. Run your finger along it one way, then the other. Can you “unzip” it and zip it back together? Feathers are amazing, and some fossils have them pressed into stone!

Video slot. Video coming. Feathered dinosaur fossils for children: Archaeopteryx, Sinosauropteryx, Microraptor; how a feather is made. Search approved channels (Natural History Museum London, American Museum of Natural History, Smithsonian National Museum of Natural History); preview first.

KEY TERMS

feather

A light covering made of a center shaft with many tiny branches, found on birds and some dinosaurs.

Archaeopteryx

A feathered animal with wings, teeth and a long bony tail, found in stone in Germany (say “ar-kee-OP-ter-iks”).

filament

A thin, hair-like strand. Some dinosaurs were covered with fuzz made of filaments.

scales

Small, hard, overlapping plates or bumps on the skin of reptiles and some dinosaurs.

CORE IDEAS

The story. In Germany there are quarries of smooth, fine stone that was once used for printing pictures. In 1861, quarry workers split open a slab and found something wonderful: the skeleton of a creature the size of a crow, with wings, and the shapes of its feathers pressed into the stone around it. It was named **Archaeopteryx**, “ancient wing.”

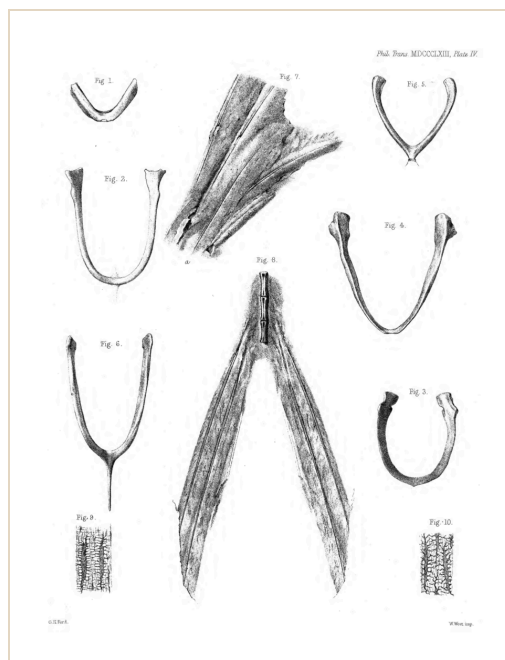
A strange bird. Archaeopteryx had feathers like a bird’s, with a shaft down the middle, and wings. But it also had teeth in its jaws, claws on its wing fingers and a long bony tail. The famous scientist Richard Owen studied one in London and called it a bird. Scientists have argued about it ever since.

Fuzz in China. In 1996, a farmer in China found a small dinosaur in fine layers of stone. Along its back and tail was a fringe of dark fuzz, made of thin **filaments**. Since then, many dinosaurs with fuzz or real feathers have been found there. One small one, Microraptor, had long feathers on its arms *and* its legs, like four wings! Other dinosaurs, like the duckbills, show skin with bumpy **scales**.

See and think. Here is what the fossils *show*: some dinosaurs had fuzz or feathers, and some had scales. Here is what people *think* it means. Most scientists today think birds came from dinosaurs over a very long time. Many Christians believe God made birds on day five and land animals on day six, as separate kinds, and that God gave feathers to some dinosaurs just as He gave scales to others. A careful thinker tells which part is the observation and which is the interpretation.

Under His wings. A mother bird spreads her feathers over her chicks to keep them warm and safe. The Bible uses that picture for God: “He shall cover thee with his feathers, and under his wings shalt thou trust” (Psalm 91:4).

PICTURE STUDY



The London Archaeopteryx, plate from Richard Owen's report, From Richard Owen's paper (artist of the plate not named here), 1863 · Lithograph (printed drawing) · Published in Philosophical Transactions of the Royal Society, London; the fossil is at the Natural History Museum, London
Wikimedia Commons · Public domain

Richard Owen read his report on the London Archaeopteryx to the Royal Society in 1862, and it was printed with careful drawings of the fossil in 1863. Before photographs were easy to print, an artist drew every bone and feather mark by hand so other scientists could study them.

Look closely

- Find the lines of the feathers. Where do they spread out from?
- Find the long tail. Does it have bones down the middle?
- Look for small claws. Where are they?

Talk about it

1. Why do you think the artist drew the fossil so carefully, line by line?
2. Which parts of this animal look like a bird's? Which do not?

HANDS-ON: FEATHER DETECTIVE

Study a real feather up close and compare it to dinosaur fuzz.

You will need

- A craft-store feather (not a feather picked up outdoors)
- A cotton ball
- A magnifying glass
- A pencil and your Field Notebook

Steps

1. Look at the feather with the magnifying glass. Find the shaft, the stiff center line.
2. Find the vanes, the soft flat sides. Gently pull two branches apart, then smooth them back together with your fingers. They “zip” back!
3. Pull a few wisps from the cotton ball. These are like the thin filaments of dinosaur fuzz: no shaft and no zipping.
4. Draw the feather and the fuzz side by side. Which would be better for flying? Which would keep a body warm?

Check your work

- I found the shaft and the vanes on my feather.
- I compared a feather to fuzz.
- I can tell one thing the fossils show and one thing people think it means.

FIELD NOTEBOOK

1. Draw Archaeopteryx. Label its feathers, its teeth, its wing claws and its long bony tail.
2. Make two columns: “The fossil shows” and “People think.” Write one sentence in each.

Did you know? Scientists can sometimes tell the color of fossil feathers! Tiny color specks inside feathers last in some fossils. The little fuzzy dinosaur from China, *Sinosauropteryx*, seems to have had a reddish-brown tail with light stripes, like a raccoon's. Only one feather was found before the first Archaeopteryx skeleton.

Goes deeper in. Life Science, the birds and classification units (coming soon); Trail D, Stop D1 “Every living thing” on day six (coming soon).

For families. An isolated feather was found at Solnhofen, Bavaria, in 1860–1861, and the first skeleton (the London specimen) in 1861; the British Museum bought it in 1862, and Owen’s description appeared in *Philosophical Transactions* (1863). *Sinosauropteryx* was found in Liaoning in 1996; its color pattern was reported by Zhang and others (*Nature* 2010) and refined later. *Microraptor* was described in 2000 and 2003. Most paleontologists hold that birds descend from theropod dinosaurs. Young-earth creationists generally hold that birds (day five) and dinosaurs (day six) were created separately; some creation scientists regard *Archaeopteryx* as a true bird and question whether all reported “protofeathers” are feathers. The stop presents the observation (fuzz, feathers and scales are found) apart from both interpretations.

PRACTICE

1. **EASY** Name two ways *Archaeopteryx* was different from birds today.
2. **MEDIUM** What was found on the small dinosaur from China in 1996?
3. **MEDIUM** “Some dinosaurs had feathers.” Is that an observation or an interpretation? “Birds came from dinosaurs.” Which is that?

Make it a game • Feather, Fuzz or Scale?. The leader names an animal: a robin, a crocodile, *Archaeopteryx*, a snake, a duckbill dinosaur, *Sinosauropteryx*, a parrot. Players flap their arms for feathers, wiggle their fingers for fuzz, or tap their arms for scales.

Scripture. “He shall cover thee with his feathers, and under his wings shalt thou trust: his truth shall be thy shield and buckler.” (Psalm 91:4, KJV)

A mother bird covers her chicks with her feathers. God keeps His people safe, and His truth protects us like a shield.

Practice: answers

1. Any two: it had teeth, claws on its wing fingers, a long bony tail.
2. Fuzz made of thin filaments along its back and tail.
3. The first is an observation (we can see it in fossils). The second is an interpretation (an explanation of what it means).

2.8 BABIES AND GROWTH

OBJECTIVES

- Tell the story of Maiasaura, the “good mother lizard.”
- Explain how growth rings in bones show how a dinosaur grew.
- Compare the size of a baby dinosaur with a grown one.

Warm-up. Ask a grown-up how long you were when you were born. Then measure how tall you are now. How many times bigger have you grown? A baby Maiasaura grew from about the length of your arm to longer than a car!

Video slot. Video coming. Maiasaura nests and babies at Egg Mountain, Montana; how dinosaurs grew, for children. Search approved channels (Museum of the Rockies, American Museum of Natural History, Field Museum); preview first.

KEY TERMS

hatchling

A baby animal that has just come out of its egg.

Maiasaura

A duck-billed dinosaur whose name means “good mother lizard” (say “MY-ah-SORE-ah”).

growth spurt

A time when a young animal or person grows very fast.

juvenile

A young animal that is no longer a baby but not yet grown up.

CORE IDEAS

The story. In 1978, in a small rock shop in Montana, a woman named Marion Brandvold showed two visiting fossil hunters, Jack Horner and Bob Makela, a coffee can of little bones. They were the bones of baby dinosaurs! She took them to the place she had found them, and there they found a bowl-shaped nest with the bones of many babies inside.

The good mother. The babies were duck-billed dinosaurs. Their little teeth were already worn down from chewing, but their leg bones were not yet strong enough for walking far. So who brought them food? Horner and Makela thought the parents must have fed them in the nest, the way robins feed their chicks. They named the dinosaur **Maiasaura**, “good mother lizard.” Nearby they found so many nests that people called the place Egg Mountain.

Small to big. A Maiasaura **hatchling** was only about as long as your arm. A grown Maiasaura was about 30 feet long, longer than a car! Dinosaurs grew fast. A young T. rex had a big **growth spurt** in its teenage years and may have gained several pounds every single day.

Rings inside the bones. How do scientists know? They cut a very thin slice of fossil bone and look at it under a microscope. Many bones have lines in them, like the rings in a tree stump. Each line may mark one year of growth. By counting the rings, scientists can guess how old a dinosaur was. The famous T. rex named SUE has growth lines that show it was about 28 years old.

Growing well. God made every creature to grow. The Bible says that when Jesus was a boy, He “increased in wisdom and stature, and in favour with God and man” (Luke 2:52). Children grow taller year by year, and they can grow in wisdom and in loving God too.

PICTURE STUDY



Hadrosaurus, Charles R. Knight, 1897 · Painting · Made for the American Museum of Natural History, New York

Wikimedia Commons · Public domain

Charles R. Knight painted these duck-billed dinosaurs in 1897, long before *Maiasaura* was found. *Maiasaura* belongs to this same family of duckbills. Knight painted animals at the zoo all his life, so his dinosaurs look like real living creatures.

Look closely

- Find the wide duck-like bill on each dinosaur.
- Look at the water and the shore. What might these animals eat here?
- Which dinosaur looks biggest? Which looks smallest?

Talk about it

1. If you added a nest of *Maiasaura* babies to this picture, where would you put it? Why?
2. How did Knight make these animals look alive and not like statues?

HANDS-ON: BABY AND GROWN-UP STRING

See how much a *Maiasaura* grew by laying out its size with string.

You will need

- A ball of string or yarn
- A tape measure
- Scissors (with a grown-up)
- Two sticky notes

Steps

1. Measure and cut a piece of string about 16 inches long (about as long as your arm). Label it “hatchling.”
2. Measure and cut a piece about 30 feet long (outside or down a long hallway). Label it “grown-up.”
3. Lay the two strings side by side. Lie down beside them. Which are you closer to?
4. Count how many hatchling strings would fit along the grown-up string.

Check your work

- I laid out a hatchling string and a grown-up string.
- I counted how many hatchlings fit along the grown-up.
- I can tell what “*Maiasaura*” means.

FIELD NOTEBOOK

1. Draw a *Maiasaura* nest with babies inside and a parent bringing leaves. Label the hatchlings.
2. Draw a bone slice with growth rings. Count your rings and write the dinosaur’s age.

Did you know? *Maiasaura* is the state fossil of Montana. In 1985 a piece of *Maiasaura* bone flew into space with an astronaut, so it was the first dinosaur in space! You can count the rings on a tree stump the same way scientists count growth rings in bone.

Goes deeper in. Life Science, the life cycles units (coming soon); and Arithmetic, for measuring and comparing lengths.

For families. The first *Maiasaura* nest was found in 1978 near Choteau, Montana, after Marion Brandvold, who ran a rock shop in Bynum, showed baby bones to John (Jack) Horner and Robert Makela; Horner and Makela named *Maiasaura peeblesorum* in *Nature* (1979). The parental-feeding idea is an interpretation from worn hatchling teeth and weak leg joints, and some scientists have questioned it. Hatchlings were roughly 16 inches (41 cm) long; adults about 30 feet (9 m). Growth-rate estimates for *T. rex* (Erickson and others, *Nature* 2004) reach about 4–5 pounds a day at peak; SUE’s age of about 28 is

from the same research. A Maiasaura bone fragment and eggshell flew aboard Spacelab 2 with Loren Acton in 1985.

PRACTICE

1. **EASY** What does the name Maiasaura mean?
2. **MEDIUM** Why did Jack Horner think Maiasaura parents fed their babies?
3. **MEDIUM** How can scientists tell how old a dinosaur was?

Make it a game • Grow, Maiasaura, Grow! Everyone starts curled up small like a hatchling in an egg. The leader calls out, “One year!” and everyone grows a little taller. At “Five years!” everyone stands tall and stretches like a grown Maiasaura. Then the leader calls, “Egg!” and everyone curls up again. Speed it up each round.

Scripture. “And Jesus increased in wisdom and stature, and in favour with God and man.” (Luke 2:52, KJV)

“Stature” means height. Jesus grew up as a real boy. We grow taller each year, and we can grow in wisdom and in loving God too.

Practice: answers

1. “Good mother lizard.”
2. The babies’ teeth were worn from eating, but their legs were not yet strong enough to walk far for food.
3. By counting growth rings inside a thin slice of its bone.

2.9 SAUROPOD NECKS

OBJECTIVES

- Tell how long the longest sauropod necks were and why they were not too heavy.
- Compare a sauropod neck with a giraffe's neck.
- Explain why scientists changed their minds about sauropods living in water.

Warm-up. Hold a broom by the very end of the handle and try to lift the brush end up high. It is hard! Now imagine holding up a neck longer than a school bus. How did the long-necked dinosaurs do it?

Video slot. Video coming. Sauropod necks for children: Brontosaurus, Diplodocus, Mamenchisaurus; hollow neck bones and air sacs; giraffe neck comparison. Search approved channels (Field Museum, American Museum of Natural History, Natural History Museum London); preview first.

KEY TERMS

sauropod

A huge plant-eating dinosaur with a long neck, a long tail, a small head and four thick legs (say "SORE-oh-pod").

vertebra

One of the bones that make up the backbone and neck (more than one are called vertebrae, say "VER-teh-bray").

air sac

A balloon-like bag of air connected to the lungs, as in birds. Some reached into sauropod bones.

hollow

Having empty spaces inside, not solid all the way through.

CORE IDEAS

The story. Imagine standing in a forest of tall trees. Something moves high above you, as high as the roof of a house. A small head, chewing leaves, swings down on the end of a long, long neck, and then up again to the treetops. It is a **sauropod**, one of the long-necked giants. Its neck lets it reach food no other animal can.

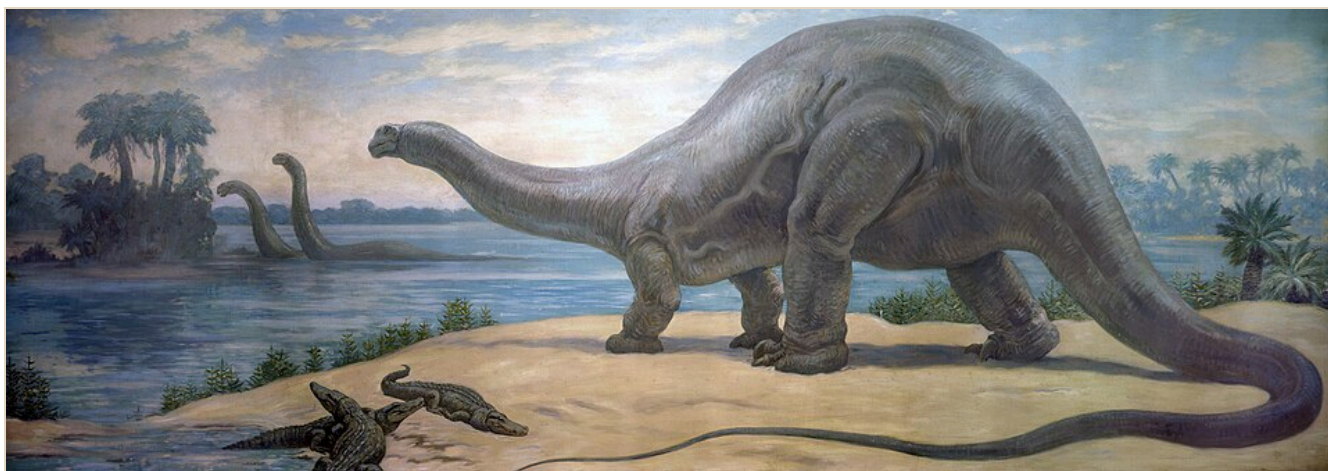
Longer than a bus. The longest sauropod necks were more than 40 feet long, longer than a school bus. A giraffe has only seven neck bones, the same number as you, but they are very long ones. Some sauropods had up to nineteen neck **vertebrae**! With a long neck, a sauropod could stand in one spot and eat from a wide circle of trees and ferns without walking much.

Light as a bird's bones. How could they hold up such long necks? God built them wisely. Sauropod neck bones were **hollow** in many places, with big spaces inside, like the bones of birds. Scientists think **air sacs** from the lungs filled those spaces, making the neck much lighter than solid bone. Strong ropes of muscle and tough cords along the neck helped hold it up, like the cables on a bridge.

In the water or on land? People once thought sauropods were too heavy to walk on land. They pictured them standing in deep lakes, letting the water hold them up. Charles Knight painted them that way. But then scientists found sauropod trackways on dry ground, and they figured out that deep water would squeeze a sauropod's chest so hard it could not breathe. Now they know sauropods walked on land on their thick, pillar-like legs.

Manifold works. Scientists still wonder how high sauropods held their heads, and how their hearts pumped blood all the way up. Every answer shows how carefully God made them. "O LORD, how manifold are thy works! in wisdom hast thou made them all" (Psalm 104:24).

PICTURE STUDY



Brontosaurus (Field Museum mural), Charles R. Knight, About 1929 · Oil painting (mural) · Field Museum, Chicago

Wikimedia Commons · Public domain

Charles R. Knight painted this mural for the Field Museum in Chicago, part of a great set of paintings he made there between 1926 and 1930. In his day, most scientists thought giant sauropods spent much of their time in water, and Knight painted what the scientists of his time believed.

Look closely

- Find the long necks. Follow one from the head all the way to the body.
- Look for water. Are the dinosaurs in it, beside it, or both?
- Compare the head to the body. Is the head big or small?

Talk about it

1. If Knight painted this picture today, what might he change?

2. Why would a small head be helpful on the end of such a long neck?

HANDS-ON: BUILD A SAUROPOD NECK

Make a neck from many small bones and test how it bends and how light it is.

You will need

- An egg carton cut into single cups (with a grown-up), or empty thread spools
- A long piece of string or a pipe cleaner
- A small ball of clay for the head
- A few drinking straws and a pencil

Steps

1. Poke a hole in the bottom of each egg cup. Thread twelve or more cups onto the string. These are the vertebrae.
2. Tie a knot at one end and press the clay head onto it.
3. Hold the other end and gently lift the neck. How does it bend? Try curving it up, down and side to side.
4. Hold a straw (hollow) in one hand and a pencil (solid) in the other. Which is lighter for its size? Why would hollow neck bones help a sauropod?

Check your work

- My neck has twelve or more vertebrae and a head.
- I can show how a long neck bends.
- I can tell why hollow bones made a long neck lighter.

FIELD NOTEBOOK

1. Draw a sauropod next to a giraffe and a school bus. Label the neck of each animal.
2. Draw a hollow neck bone (with spaces inside) and a solid bone. Write: "Hollow bones are lighter."

Did you know? The name Brontosaurus means "thunder lizard." For many years scientists said Brontosaurus was really the same animal as Apatosaurus and stopped using the name. Then in 2015 some scientists studied the bones again and said Brontosaurus was different enough to keep its own name. Science keeps checking! Some Christians also think of the great beast Behemoth in Job 40 when they see a sauropod (Trail D, Stop D2).

Goes deeper in. Life Science, for skeletons, lungs and the heart (coming soon); and Arithmetic, for comparing lengths.

For families. Neck-length estimates for the longest sauropods (such as Mamenchisaurus sinocanadorum and Supersaurus) run from roughly 40 to nearly 50 feet; the stop says

“more than 40 feet.” Mamenchisaurus had 19 cervical vertebrae. Air-filled (pneumatic) vertebrae are observed; the air-sac system is inferred by comparison with birds. Kenneth Kermack (1951) argued that water pressure would make deep wading impossible, and sauropod trackways on land were documented by Roland T. Bird and others. Neck posture and blood pressure are still debated. Brontosaurus was reinstated as a genus by Tschopp, Mateus and Benson (2015). Knight’s Field Museum murals were painted 1926–1930; the date of this panel is given as about 1929.

PRACTICE

1. **EASY** How many neck bones does a giraffe have? How many did some sauropods have?
2. **MEDIUM** What made a sauropod’s long neck lighter?
3. **MEDIUM** Why did scientists stop thinking sauropods lived in deep water?

Make it a game • Long-Neck Reach. Hang paper “leaves” at different heights around the room or yard with tape. Players are sauropods: they must keep both feet planted in one spot and reach with their arms (the neck) to collect as many leaves as they can. Then try it as a short-necked dinosaur with elbows tucked in.

Scripture. “O LORD, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches.” (Psalm 104:24, KJV)

“Manifold” means many and different. A giant with a hollow, light neck shows God’s wisdom in the way He made each creature.

Practice: answers

1. A giraffe has seven. Some sauropods had up to nineteen.
2. Its neck bones were hollow, with spaces probably filled by air sacs.
3. They found sauropod trackways on land, and deep water would have squeezed their chests so they could not breathe.

2.10 DINOSAUR SOUNDS

OBJECTIVES

- Tell why we cannot be sure what dinosaurs sounded like.
- Explain how Parasaurolophus may have used its hollow crest to make sound.
- Make a low and a high sound with tubes of different lengths.

Warm-up. Roar like a movie dinosaur! Now close your mouth and hum as low as you can, so your chest buzzes. Some scientists think real dinosaurs may have made sounds more like that low hum than a big roar.

Video slot. Video coming. What did dinosaurs sound like? Parasaurolophus crest sound model; birds and crocodiles calling with closed mouths, for children. Search approved channels (Natural History Museum London, American Museum of Natural History, Cornell Lab of Ornithology for bird sounds); preview first.

KEY TERMS

crest

A bony shape on top of an animal's head.

Parasaurolophus

A duck-billed dinosaur with a long, hollow, tube-shaped crest (say “PAR-ah-sore-OL-oh-fus”).

voice box

The part in the throat that makes sounds for calling and singing.

pitch

How high or low a sound is.

CORE IDEAS

The story. About a hundred years ago, fossil hunters in Alberta, Canada, dug up the skull of a duck-billed dinosaur with something strange on its head: a long, curved tube sweeping back like a horn. Later, scientists found that the tube was hollow inside. Think of a trumpet or a church organ pipe. Long, hollow tubes make deep, booming sounds. Could this dinosaur have played its own head like a horn?

Sounds don't fossilize. We can dig up bones, teeth, eggs and footprints, but a sound is gone the moment it ends. And the soft **voice box** in the throat almost never turns into a fossil. So no one knows for sure what dinosaurs sounded like. Scientists look for clues instead.

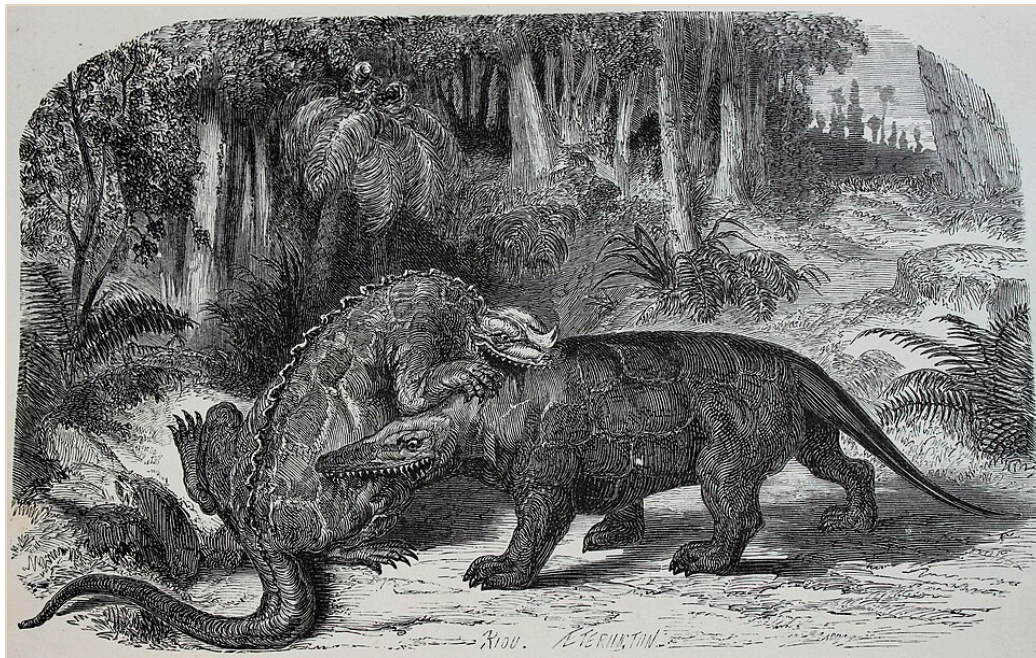
The trumpet crest. **Parasaurolophus** had a long, curved **crest** on the back of its head, longer than a baseball bat. Inside, tubes ran from its nose up into the crest and back down

again. Scientists made a computer model of the crest and played air through it. Out came a deep, rumbling, horn-like sound, like a low note on a tuba. Each *Parasaurolophus* may have called to its herd this way.

Clues from cousins. Dinosaurs' nearest living relatives are birds and crocodiles. Crocodiles bellow and rumble. Many birds, like doves and emus, make booming sounds with their mouths closed. In 2023, scientists described the voice-box bones of an armored dinosaur from Mongolia, and they looked a bit like a bird's. Maybe some dinosaurs boomed, honked, hissed or even chirped, but probably not the roars from the movies!

Everything that hath breath. Whatever sounds the dinosaurs made, they made them with the breath God gave them. The last verse of the Psalms calls every creature to join in: "Let every thing that hath breath praise the LORD" (Psalm 150:6). Our voices are for praising God too.

PICTURE STUDY



Iguanodon and Megalosaurus, from The World Before the Deluge, Édouard Riou, 1863 · Engraving (printed illustration) · From Louis Figuier's book La Terre avant le déluge ("The Earth Before the Deluge"), Paris, 1863

Wikimedia Commons · Public domain

Édouard Riou, a French artist who also drew pictures for Jules Verne's adventure books, made this picture for a popular book about ancient animals. He followed the ideas of his day, so his dinosaurs look like giant lizards on four legs. He drew them with their mouths wide open, as if roaring.

Look closely

- Find the two dinosaurs. Which one has a horn on its nose?
- Look at their mouths. What sound do you imagine they are making?

- Look at the land and sky. How did Riou make the scene feel wild?

Talk about it

1. Riou could not hear a real dinosaur. How do you think he decided they would roar?
2. Iguanodon's "nose horn" turned out to be a thumb spike. What does that teach us about guessing?

HANDS-ON: CREST HORN

Make a Parasaurolophus horn from tubes and hear how a longer tube makes a lower sound.

You will need

- A short cardboard tube (toilet paper tube)
- A long cardboard tube (wrapping paper tube or paper towel tubes taped together)
- Tape and markers

Steps

1. Decorate the long tube like a Parasaurolophus crest.
2. Put your lips to the short tube and hum "ooo" as low as you can. Listen.
3. Now hum the same way into the long tube. Is the sound louder? Deeper? Does the tube buzz?
4. Try humming the same note in each tube and listen to which tube booms. Tell a grown-up: does a longer tube make a higher or a lower pitch?

Check your work

- I made a crest horn from a long tube.
- I compared a short tube and a long tube.
- I can tell why no one knows exactly what dinosaurs sounded like.

FIELD NOTEBOOK

1. Draw Parasaurolophus with its long crest. Draw the tube inside the crest from the nose, up and back down.
2. Write a list of sounds a dinosaur might have made: boom, honk, hiss, rumble. Circle your best guess.

Did you know? Some large animals today, like elephants, make sounds so low that people can barely hear them, but they travel a long way. Scientists who studied the ears of some dinosaurs think they heard low sounds best. A Parasaurolophus herd might have called to each other across a valley with deep, low booms.

Goes deeper in. Life Science, for hearing and sound (coming soon); and Art, for how artists picture things no one has seen.

For families. The Parasaurolophus sound model was made in 1997 by Tom Williamson (New Mexico Museum of Natural History) and Carl Diegert (Sandia National Laboratories) from CT scans of a skull. The closed-mouth vocalization hypothesis is from Riede and others (*Evolution*, 2016). The ankylosaur Pinacosaurus larynx was described by Yoshida and others (*Communications Biology*, 2023). Riou’s illustrations appeared in Figuier’s *La Terre avant le déluge* (1863; English translation *The World Before the Deluge*, 1865). Parasaurolophus was named by William Parks in 1922 from a skull found in Alberta in 1920 by a University of Toronto team; the stop says “about a hundred years ago.” In the project, a tube resonates best at certain notes, and longer tubes favor lower notes.

PRACTICE

1. **EASY** Why don’t we know for sure what dinosaurs sounded like?
2. **MEDIUM** How might Parasaurolophus have used its crest?
3. **MEDIUM** Which living animals give scientists clues about dinosaur sounds?

Make it a game • Find Your Herd. Each player secretly picks one dinosaur call: a low boom, a honk, a hiss or a chirp (two players get each sound). Everyone closes their eyes (or a grown-up guides them in a safe open space) and makes their call softly. Players find the others with the same call by listening. The first herd together wins.

Scripture. “Let every thing that hath breath praise the LORD. Praise ye the LORD.” (Psalm 150:6, KJV)

The very last verse of the Psalms calls every breathing creature to praise God. We can use our voices to praise Him.

Practice: answers

1. Sounds do not leave fossils, and the soft voice box almost never fossilizes.
2. Air blew through hollow tubes inside the crest to make a deep, horn-like call.
3. Birds and crocodiles.

TRACK 2 BADGE QUIZZES

The badge quizzes are optional. Read each question aloud; the child may answer by talking, pointing or drawing. Four right out of five earns the badge. Badges and the certificate are earned by doing the stops, not by scores.

Badge quiz 1 (Stops 1–5)

1. A tooth is sharp, curved and has tiny bumps on its edges. Did its owner eat meat or plants?
2. What was the Citipati found in the Gobi Desert doing?
3. What is a trace fossil? Give one example.
4. Name one clue that some dinosaurs lived in herds.
5. How do footprints show that a dinosaur was running?

Badge quiz 2 (Stops 6–10)

6. What is the difference between a warm-blooded and a cold-blooded animal?
7. Name two ways Archaeopteryx was different from birds today.
8. What does Maiasaura mean?
9. What made a sauropod's long neck light enough to hold up?
10. How might Parasaurolophus have used its hollow crest?

TRAIL CERTIFICATE: MY DINOSAUR DETECTIVE NOTEBOOK AND TRAIL C CERTIFICATE

Gather the Field Notebook pages from this trail into one booklet with a cover: "My Dinosaur Detective Notebook," your name and the dates you started and finished.

Add a "Clues" page: draw one fossil clue for each stop (a tooth, an egg, a footprint, a trackway map, a stride, a growth ring, a feather, a neck bone, a crest) and write what it tells us.

Add the plaster track cast from Stop C3, or a photo of it.

When the booklet is done, a parent signs the Trail C certificate.

- **Ten stops:** At least one page for each stop, each with a title and a date.
- **Clues page:** Each clue is drawn and matched with what it tells us about how dinosaurs lived.
- **Observe or interpret:** The child can say what a fossil shows and, separately, what people think it means (Stop C7).
- **Care:** Drawings are labeled and done carefully.

Answer key

1. Meat. Sharp, serrated teeth cut meat.
2. Sitting on its nest, keeping its eggs warm and safe (brooding).
3. A fossil that shows something an animal did, such as a footprint, a nest or a burrow.

4. Either: parallel trackways going the same way, or bonebeds with many dinosaurs of one kind buried together.
5. The footprints are farther apart (a longer stride).
6. A warm-blooded animal makes its own body heat; a cold-blooded animal gets its warmth from outside, like the sun.
7. Any two: teeth, claws on its wing fingers, a long bony tail.
8. "Good mother lizard."
9. Hollow neck bones, probably filled with air sacs.
10. To make a deep, horn-like call by blowing air through the tubes inside.

SCHOOL LAUNCH · EXPLORE TRACKS

EXPLORE TRACKS · TRAIL D

The fourth trail of three interest tracks for curious Scouts: Animals (ocean life), Dinosaurs (dinosaurs and the Bible) and Great Battles of the Nineteenth Century. Short, self-paced stops with true stories, great pictures, hands-on projects and games.

First edition

O LORD, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches. So is this great and wide sea, wherein are things creeping innumerable, both small and great beasts.
Psalm 104:24-25 (KJV)

COURSE GUIDE

Explore Tracks are for children who want more of what they love. Each track is a trail of short stops. At every stop the child hears a true story, studies a great picture, does something with his or her hands, plays a game and adds a page to a Field Notebook. Each stop also points to the matching lesson in a School Launch course, so the child can go deeper.

Trail D is the fourth trail of each track at the  Scout level (ages 7–9). The Animals track goes down into the sea, from sharks, octopuses and coral reefs to the dark home of the anglerfish, and ends with Jonah’s great fish and the Leviathan of the Bible. The Dinosaurs track opens the Bible beside the fossils: the living things God made, Behemoth (Job 40) and Leviathan (Job 41), the Ark and the Flood, dragon stories from around the world, and how to read a museum sign carefully. The Great Battles track visits eight battles of the nineteenth century, from Waterloo (1815) to Appomattox (1865), five of them from the American Civil War. Trails A–C are not required first.

WHO IT IS FOR

Written for children about ages 7–9 who are read to by a parent, or who read short passages on their own. Older siblings can join in. Nothing earlier is required.

HOW TO USE THIS COURSE

1. **One stop at a time.** A stop takes 15–25 minutes: read the story aloud, look at the picture, do the hands-on part and play the game. Two or three stops a week works well.
2. **Any order.** The tracks are independent. Do one track at a time, or rotate between them.
3. **Field Notebook.** Every stop ends with a page for the notebook. At the end of the trail the pages become a booklet, and the parent signs the Trail D certificate.
4. **Badge quizzes.** Each track has two short, optional oral quizzes. They are for fun, not grades.

SCOPE AND SEQUENCE

Track 2: Dinosaurs  Trail D: Dinosaurs and the Bible (Self-paced)

MATERIALS

- **Field Notebook (a sketchbook or composition book)** One for the whole trail.
- **Colored pencils, a ruler, scissors and glue** For drawings, terrain maps and ocean-depth charts.
- **Household things** Each hands-on project lists what it needs: blocks, clay, string, toy figures, cups, a shallow pan or box of sand.
- **A Bible (KJV)** For the verse at each stop.

GRADING

Explore Tracks are not graded. A stop is done when the child has heard the story, done the hands-on part and made a notebook page.

Badges and the Trail D certificate are earned by finishing the stops.

A NOTE TO PARENTS

You do not need to be an expert. Read the story aloud, look at the picture together and ask, “What do you notice?” Each stop has a short *For families* note with background and any facts that scholars still discuss.

Ocean life: the Animals stops tell what scientists have observed and what is still unknown, especially about the deep sea and the giant squid, which was first filmed alive in its deep home only in 2012. The last stop reads Jonah and the Leviathan passages as true Scripture; where the Bible does not name an exact kind of animal, the stop says so rather than guessing.

Dinosaur dates: museums give ages in millions of years. Stops marked ⌚ (D5, D7, D8 and D9) include a short box with three parts: *What the sign says*, *What we observe* and *How Christians read it*. The trail teaches the period names as museum words and explains that the dates are interpretations; many Christian families understand the fossils within a young earth and the Flood. Where Christians differ, as on what happened to the dinosaurs, each view is presented fairly.

Battles are told for young children: the map, the plan, the people and why it mattered, with honor for courage, faith and wisdom and no gory detail. Losses are given as numbers, and wounds and deaths are stated plainly but not described. Both sides are described fairly, in the terms of their own time. The Civil War stops say plainly that slavery was the central cause of secession, as the seceding states’ own declarations said, while honoring the courage of soldiers on both sides. The trail ends with Grant’s generous terms at Appomattox.

CONTENTS

Track 2: Dinosaurs 🦖 Trail D: Dinosaurs and the Bible

- 2.1 “Every Living Thing” on Day Six
- 2.2 Behemoth (Job 40)
- 2.3 Leviathan (Job 41)
- 2.4 Dinosaurs on the Ark?
- 2.5 Fossil Graveyards and the Flood ⌚
- 2.6 Dragon Legends Worldwide
- 2.7 What Happened to the Dinosaurs? Each View ⌚
- 2.8 Reading a Museum Sign ⌚
- 2.9 Soft Tissue and Dating ⌚
- 2.10 Fearfully Made: Design in Dinosaurs

Each stop takes 15–25 minutes. Tracks may be done in any order, and a child may do just one track.

DINOSAURS TRAIL D: DINOSAURS AND THE BIBLE

The fourth trail of the Dinosaurs track opens the Bible beside the fossils: the land animals God made on day six, behemoth and leviathan in the Book of Job, dinosaurs on Noah's Ark, fossil graveyards and the Flood, dragon legends around the world, what happened to the dinosaurs, how to read a museum sign, soft tissue and dating, and the wonderful designs God built into dinosaurs. Each stop is a short read-aloud story, a picture to study, something to make, quick questions, a game and a verse of Scripture.

This is the  **Scout** level, for ages 7 to 9. A parent reads the story aloud, or a strong reader reads it alone, and every stop stands by itself. The trail is creation-friendly: it teaches Genesis as true history and shows how many creation scientists read the rocks. Period names such as **Jurassic** and **Cretaceous** are taught as "museum words," and dates on museum signs are called what they are: interpretations. Stops D5, D7, D8 and D9 have the  box: *What the sign says / What we observe / How Christians read it*. Other views are named fairly, and no one is mocked.

Five stops earn the **Bible and Bones badge, part 1**, and ten stops earn part 2 and the **Trail D certificate**. The badge quizzes are at the end of the trail and are optional.

BEFORE YOU BEGIN

- Know the six days of creation and the story of Noah's Ark (Genesis 1 and 6-9), or read them together first.
- Know what a fossil is (Trail A or Trail B, or ask a grown-up).

MASTERY CHECKLIST

- ☐ I can tell on which day God made the land animals, and why many Christians say dinosaurs were made that day.
- ☐ I can tell what Job 40 says about behemoth and what Job 41 says about leviathan.
- ☐ I can explain how dinosaurs could have fit on the Ark and why fossil graveyards need quick burial.
- ☐ I can tell two views of what happened to the dinosaurs without making fun of either one.
- ☐ I can read a museum sign and sort it into what we observe and what people interpret.

OPTIONAL BOOKS AND RESOURCES

- **Blue Letter Bible** (<https://www.blueletterbible.org>): Free King James Bible online for reading Genesis 1, Genesis 6-9 and Job 40-41 together.
- **Answers in Genesis Kids** (<https://answersingenesis.org/kids/>): Free creation articles and activities for children on dinosaurs, the Ark and the Flood; preview first.

- **Dinosaur National Monument (National Park Service)** (<https://www.nps.gov/dino>): Photos of the bone wall in the Quarry Exhibit Hall for Stop D5. Read the park's signs with the  box in mind.
- **Biodiversity Heritage Library** (<https://www.biodiversitylibrary.org>): Free old books, including Louis Figuier's *The World Before the Deluge* with Riou's engravings (Stop D7).

2.1 “EVERY LIVING THING” ON DAY SIX

OBJECTIVES

- Tell what God made on the fifth day and on the sixth day of creation.
- Explain why many Christians say God made the dinosaurs on day six.
- Say Genesis 1:25 and tell what “after his kind” means.

Warm-up. Hold up six fingers and count the days of creation: light; the sky; land and plants; sun, moon and stars; fish and birds; land animals and people. On that sixth finger, God made the land animals, and the dinosaurs walked on land!

Video slot. Video coming. The six days of creation for children; the land animals of day six. Search approved channels (Answers in Genesis Kids, Institute for Creation Research, Creation Ministries International); preview first.

KEY TERMS

creation

Everything God made, and the six days in which He made it (Genesis 1).

kind

A family of animals God made to have babies like themselves. One kind can have many varieties, like all the different dogs.

land animal

An animal that lives and breathes on dry ground, not in the sea.

very good

What God said about everything He had made at the end of the sixth day (Genesis 1:31).

CORE IDEAS

The story. In the beginning there were no animals at all. Then God spoke. On the fifth day He filled the seas with fish and great sea creatures, and He filled the sky with birds. Then came the sixth day. God said, “Let the earth bring forth the living creature after his kind” (Genesis 1:24). And across the new green land, animals began to walk, run, creep and graze.

Day six. On the sixth day God made cattle, creeping things and “the beast of the earth.” Dinosaurs were land animals. Their bones are found in rock that was once mud and sand, and their footprints are pressed into what was once soft ground. So many Christians believe God made the dinosaurs on day six, the same day He made Adam and Eve. The great swimming reptiles and flying reptiles were not dinosaurs; they fit with the sea and sky creatures of day five.

After his kind. Genesis says again and again that God made animals “after his kind.” That means each kind has babies like itself. A Triceratops egg hatched a baby Triceratops, never a

chicken. A kind can have many varieties, the way a Great Dane and a Chihuahua are both dogs.

Green plants for food. God told Adam that He had given “every green herb for meat” to the beasts of the earth (Genesis 1:30). In old English, “meat” means food. Many Christians believe that at first even the biggest dinosaurs ate plants, and that animals began to hunt each other only after sin came into the world. Christians think about this in more than one way, but all agree that God made a good world.

Very good. When the sixth day ended, “God saw every thing that he had made, and, behold, it was very good” (Genesis 1:31). Soon after, God brought the animals to Adam to see what he would name them (Genesis 2:19). The Bible does not tell us those names, but Adam may have been the very first person ever to see a dinosaur!

PICTURE STUDY



The Creation of the Animals, Jacopo Tintoretto, About 1550-1553 · Oil on canvas · Gallerie dell'Accademia, Venice, Italy
Wikimedia Commons · Public domain

Tintoretto lived in Venice, Italy, almost five hundred years ago. He painted God rushing over the world, calling the animals into being. The painting is full of motion, as if creation is happening right now.

Look closely

- Find God. Which way is He flying, and what is His hand doing?
- Find the birds, the fish and the land animals. Which days of creation do they belong to?
- Look at the birds and the fish. Do they look still or moving?

Talk about it

1. Why do you think the painter made everything look fast and busy?
2. If you painted day six, which dinosaurs would you put in the picture?

HANDS-ON: DAY FIVE AND DAY SIX CLAY ANIMALS

Make clay creatures and sort them into the days God made them.

You will need

- Modeling clay or play dough in several colors
- Two sheets of paper labeled “Day 5: sea and sky” and “Day 6: land”
- A toothpick for drawing scales and eyes

Steps

1. Make one fish and one bird from clay. Put them on the Day 5 paper.
2. Make one dinosaur you know, such as a Stegosaurus with plates or a Triceratops with three horns. Put it on the Day 6 paper.
3. Make one more land animal that lives today, like a cow or a lizard, and put it beside your dinosaur.
4. Use the toothpick to add eyes, scales and toes. Tell a grown-up why each animal belongs on its day.

Check your work

- I made at least four clay animals.
- My dinosaur is on the Day 6 paper.
- I can tell what “after his kind” means.

FIELD NOTEBOOK

1. Fold a page in half. Draw day five on one side (fish and birds) and day six on the other (a dinosaur, a cow and a person).
2. Copy Genesis 1:25 in your best handwriting.

Did you know? The word “dinosaur” was not made up until 1842, more than two hundred years after the King James Bible was printed in 1611. That is why you will not find the word “dinosaur” in the Bible, just as you will not find “kangaroo” or “penguin.” But the Bible does say God made every beast of the earth.

Goes deeper in. Life Science, the creation unit, and Earth Science, the creation and Flood units (coming soon).

For families. This track takes a creation-friendly, young-earth reading of Genesis 1, with land animals (dinosaurs among them) made on day six (Genesis 1:24-25). Christians hold different views on the days of creation; the course names them fairly in Grade 8. The “great whales” of Genesis 1:21 translate the Hebrew *tanninim*, which can mean large sea

creatures in general. The plant-eating reading comes from Genesis 1:29–30; permission for people to eat meat is given after the Flood (Genesis 9:3). The story says Christians think about the early diet “in more than one way.”

PRACTICE

1. **EASY** On which day did God make the land animals?
2. **MEDIUM** Why do many Christians say dinosaurs were made on day six and not day five?
3. **EASY** What does “after his kind” mean?

Make it a game • Day Five or Day Six?. The leader calls out an animal. If it was made on day five (fish, whale, bird), players flap their arms or swim with their hands. If it was made on day six (cow, lion, T. rex, Brachiosaurus), players stomp like a dinosaur. Anyone who mixes up the motion becomes the next caller.

Scripture. “And God made the beast of the earth after his kind, and cattle after their kind, and every thing that creepeth upon the earth after his kind: and God saw that it was good.” (Genesis 1:25, KJV)

God made every land animal, from the tiniest beetle to the biggest dinosaur, and He called them good.

Practice: answers

1. The sixth day.
2. Dinosaurs were land animals: they walked on the ground and left footprints. Day six is when God made the land animals.
3. Each kind of animal has babies like itself.

2.2 BEHEMOTH (JOB 40)

OBJECTIVES

- Tell three things Job 40 says about behemoth.
- Name two ideas Christians have about what behemoth was.
- Tell why God showed Job such a mighty animal.

Warm-up. Go outside and hug a tree trunk, or pretend to. Feel how thick and strong it is. God told Job that behemoth “moveth his tail like a cedar,” a big, tall tree!

Video slot. Video coming. Behemoth in Job 40 for children; what was behemoth? Search approved channels (Answers in Genesis Kids, Institute for Creation Research, Creation Ministries International); preview first.

KEY TERMS

Job

A good man in the Bible who suffered great trouble and kept trusting God (say “JOBE”).

behemoth

A huge, strong, grass-eating animal God described to Job (say “bih-HEE-muth”).

cedar

A tall, strong tree with a thick trunk, famous in Bible lands.

sauropod

A giant plant-eating dinosaur with a long neck and a long tail, like Brachiosaurus or Diplodocus.

CORE IDEAS

The story. Job was a good man who loved God. Then terrible troubles came. He lost his animals, his children and his health. Job sat in sadness and asked, “Why?” His friends argued with him for a long time. At last God Himself answered Job “out of the whirlwind” (Job 38:1). God asked Job about the stars, the sea and the animals. Then He said, “Behold now behemoth, which I made with thee.”

What God said. Behemoth “eateth grass as an ox.” His strength was in his hips and belly. “He moveth his tail like a cedar.” His bones were “like bars of iron.” He rested under shady trees by the water, and when the river rushed and flooded, he was not afraid. God called him “the chief of the ways of God,” the greatest of the animals (Job 40:15–24).

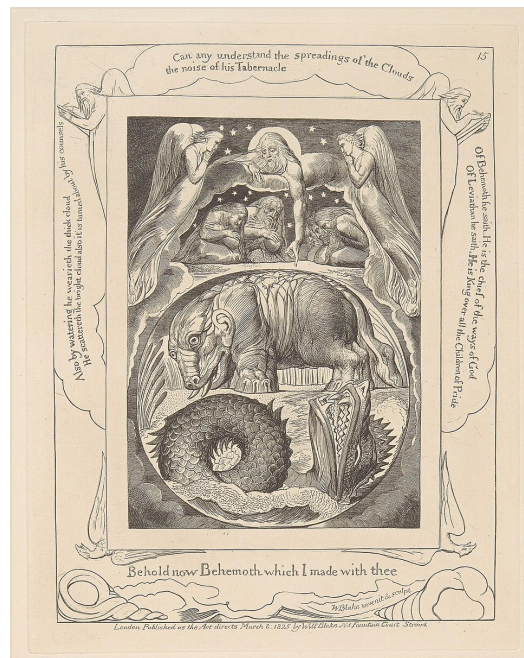
What was it? Some Bible teachers think behemoth was a hippopotamus or an elephant. Hippos eat grass and lie in rivers, and elephants are very strong. But a hippo’s tail is short and stubby, and an elephant’s tail is thin like a rope. Neither is much like a cedar tree. Many

creation Christians think behemoth may have been a sauropod, a giant long-necked dinosaur whose thick tail could be as long as a school bus.

What we know. The Bible does not give us a picture, so we cannot be sure. But we do know two things. God made behemoth “with thee,” with Job and all people, and Job could go and look at it. So behemoth was a real animal that lived in Job’s day, and it was the mightiest creature he knew.

Why God showed Job. God was not only giving Job a science lesson. He was showing Job how great, strong and wise He is. If God made behemoth and rules over it, He can surely take care of Job. Job bowed before God and trusted Him, and in the end “the LORD gave Job twice as much as he had before” (Job 42:10).

PICTURE STUDY



Behemoth and Leviathan, Plate 15 of Illustrations of the Book of Job, William Blake, 1825 · Engraving · From Illustrations of the Book of Job; copies are in the Tate (London) and other collections
Wikimedia Commons · CC0

William Blake was an English poet and artist who loved the Book of Job. He made twenty-one pictures of Job's story. In this one, God points down to show Job two great creatures: behemoth on the land and leviathan in the sea.

Look closely

- Find behemoth. What animal does Blake make him look like?
- Find God's hand. Where is He pointing?
- Look at the circle around the two creatures. Why might Blake have put them inside it?

Talk about it

1. Does Blake's behemoth have a tail "like a cedar"? How would you draw it?
2. How do you think Job felt when God showed him these creatures?

HANDS-ON: A TAIL LIKE A CEDAR

Measure three tails with string and see which one could move "like a cedar."

You will need

- A ball of string or yarn
- A tape measure
- Scissors (with a grown-up)
- Three paper tags labeled "hippo," "elephant" and "Diplodocus"

Steps

1. Cut a string about 1½ feet long. Tie on the "hippo" tag. That is about as long as a hippo's tail.
2. Cut a string about 4 feet long for the elephant's tail.
3. Outside, stretch out a string about 40 feet long for a Diplodocus tail. Walk along it and count your steps.
4. Lay the three strings side by side. Find a tree trunk. Which tail could look most like a cedar?

Check your work

- I measured three tails.
- I counted my steps along the longest one.
- I can tell two ideas about what behemoth was.

FIELD NOTEBOOK

1. Draw behemoth the way Job 40 describes him: eating grass, standing by a river, with a tail like a cedar. Write "Job 40:15" under your picture.
2. Write one sentence: "God is greater than behemoth."

Did you know? Many Bible scholars think Job may be one of the oldest stories in the Bible, telling of a man who lived long ago, around the time of Abraham. The word "behemoth" comes from the Hebrew word for "beast" and may mean something like "the great beast" or "the beast of beasts."

Goes deeper in. Literature, the Bible as literature (Job's poetry), and Life Science, for hippos, elephants and sauropods (coming soon).

For families. Behemoth is described in Job 40:15-24. Many commentaries identify it as a hippopotamus or elephant (some read "tail" as an elephant's trunk); many young-earth creationists suggest a sauropod, pointing to the tail "like a cedar" and to "made with

thee” (made on day six). The stop presents both without mockery and does not claim certainty. Tail lengths are rough: hippo about 14–22 inches, elephant about 3½–5 feet, Diplodocus roughly 40 feet. The dating of Job’s setting is traditional and uncertain.

PRACTICE

1. **EASY** What did behemoth eat?
2. **MEDIUM** Why do many creation Christians think behemoth might have been a sauropod?
3. **MEDIUM** Why did God show Job behemoth?

Make it a game • Behemoth Says. Play like “Simon Says,” but the leader says “Behemoth says.” Use behemoth moves: “Behemoth says eat grass” (pretend to munch), “Behemoth says swing your tail” (swing your arm slowly like a heavy tail), “Behemoth says stand in the river.” If the leader does not say “Behemoth says,” do not move!

Scripture. “Behold now behemoth, which I made with thee; he eateth grass as an ox.” (Job 40:15, KJV)

God made behemoth, and He made Job too. The God who made the mightiest animal also cares for each one of us.

Practice: answers

1. Grass, like an ox.
2. Because God said he moved his tail like a cedar, and sauropods had huge, thick tails. A hippo or elephant tail is small.
3. To show Job how great and strong God is, so Job could trust Him.

2.3 LEVIATHAN (JOB 41)

OBJECTIVES

- Tell three things Job 41 says about leviathan.
- Name two ideas Christians have about what leviathan was.
- Tell what Job learned about God from leviathan.

Warm-up. Try to lift a sofa with one finger. Could you do it? God asked Job, “Canst thou draw out leviathan with an hook?” Job knew the answer: no!

Video slot. Video coming. Leviathan in Job 41 for children; crocodiles and great sea reptiles. Search approved channels (Answers in Genesis Kids, Institute for Creation Research, Creation Ministries International); preview first.

KEY TERMS

leviathan

A fierce, armored creature of the water that God described to Job (say “leh-VY-uh-thun”).

scales

Hard, flat plates that cover the skin of fish and reptiles.

the deep

An old Bible name for the deep waters of the sea.

humble

Not proud; knowing that God is greater than we are.

CORE IDEAS

The story. After God showed Job behemoth on the land, He told him about a creature even more fearsome, in the water. “Canst thou draw out leviathan with an hook?” God asked. Could Job catch him with a fishing line? Could he keep him as a pet, or “play with him as with a bird”? Job sat silent. No one could do that.

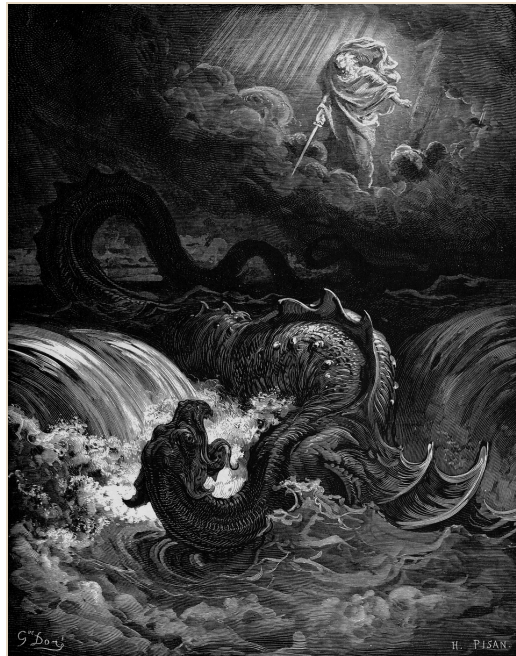
What God said. Leviathan’s scales were packed so tightly together that no air could get between them. Swords and spears did not hurt him; iron was like straw to him. When he swam, “he maketh the deep to boil like a pot,” and he left a shining trail of foam behind him. “Upon earth there is not his like, who is made without fear” (Job 41:33).

Fire and smoke? God also said, “Out of his mouth go burning lamps, and sparks of fire leap out,” and smoke came from his nose. Some Christians think this is poetry, like saying a hot spray looked like fire. Others think it might have been real in some way. After all, God made the bombardier beetle, a tiny bug that shoots a hot, popping spray out of its body to scare away enemies!

What was it? Some Bible teachers think leviathan was a crocodile, with its tough armor and rows of teeth. Others think of a great whale. Many creation Christians wonder if it was one of the huge sea reptiles whose bones are found as fossils today. Psalm 104 says leviathan plays in the sea where the ships go. We cannot be sure, but we know leviathan was mighty, and God made him.

What Job learned. God said, “None is so fierce that dare stir him up: who then is able to stand before me?” If no one can stand up to leviathan, how much greater is the God who made him! Job became humble. He said to God, “I know that thou canst do every thing” (Job 42:2).

PICTURE STUDY



The Destruction of Leviathan, Gustave Doré, 1865 · Wood engraving · From *La Grande Bible de Tours* (Paris)
Wikimedia Commons · Public domain

Gustave Doré was a French artist who made more than two hundred pictures for a large Bible. This one shows a verse from Isaiah 27:1, where God promises to punish “leviathan that crooked serpent.” Doré imagined leviathan as a huge serpent of the sea.

Look closely

- Follow leviathan’s long body with your finger. How many curves can you count?
- Find the angel. Where is the light coming from?
- Look at the waves. Are they calm or wild?

Talk about it

1. Is Doré’s leviathan more like a crocodile, a whale or a sea reptile?
2. Why do you think the artist made the top of the picture bright and the bottom dark?

HANDS-ON: DRAW FROM THE WORDS

Artists like Doré read the words of the Bible and then drew what they imagined. Now you try it.

You will need

- Paper and crayons or colored pencils
- A Bible open to Job 41, or the verse cards below

Steps

1. A grown-up writes four clue cards: “His scales are his pride” (41:15). “He maketh the deep to boil like a pot” (41:31). “He maketh a path to shine after him” (41:32). “Upon earth there is not his like” (41:33).
2. Read one card at a time and add that part to your drawing: tight scales, bubbling water, a shining trail of foam.
3. Draw a small fishing boat near leviathan to show how big he is.
4. Show your picture and tell which verse each part came from.

Check your work

- My drawing uses all four clues.
- I put a boat in to show size.
- I can tell two ideas about what leviathan was.

FIELD NOTEBOOK

1. Paste or copy your leviathan drawing into your Field Notebook. Write “Job 41” at the top.
2. Write: “Leviathan is mighty, but God is mightier.”

Did you know? Leviathan is named in four books of the Bible: Job, Psalms (74 and 104), and Isaiah (27). The bombardier beetle mixes two chemicals inside its body, and the mix pops out hot, close to the temperature of boiling water, with a tiny bang.

Goes deeper in. Literature, the Bible as literature (Job’s poetry), and Life Science, for crocodiles, beetles and sea reptiles (coming soon).

For families. Leviathan appears in Job 3:8 and 41, Psalm 74:14, Psalm 104:26 and Isaiah 27:1. Commentaries often suggest a crocodile; others a whale or a poetic sea monster. Many young-earth writers suggest a large marine reptile such as a plesiosaur or Kronosaurus, and some suggest the fire language may describe a real chemical defense, comparing the bombardier beetle. The stop presents these as possibilities, not certainties. Doré’s engraving illustrates Isaiah 27:1, not Job, which the intro says plainly.

PRACTICE

1. **EASY** Where did leviathan live: on land or in the water?
2. **EASY** Name one thing Job 41 says about leviathan.
3. **MEDIUM** What did Job learn from leviathan?

Make it a game • Leviathan's Scales. Several players stand close together, shoulder to shoulder, like leviathan's tight scales. One player, the fisher, gently rolls a soft ball and tries to get it through a gap between their feet. If the scales stay tight, the ball cannot get through! Take turns being the fisher.

Scripture. "Canst thou draw out leviathan with an hook? or his tongue with a cord which thou lettest down?" (Job 41:1, KJV)

No one could catch leviathan with a fishing hook, but God made him and rules over him. Nothing is too strong for God.

Practice: answers

1. In the water (the sea, "the deep").
2. Any one: tight scales; swords and spears could not hurt him; he made the deep boil like a pot; he left a shining path; sparks and smoke came from him; no one could catch him with a hook.
3. That God is far greater and stronger than anything He made, so Job became humble and trusted Him.

2.4 DINOSAURS ON THE ARK?

OBJECTIVES

- Tell what God told Noah to bring onto the Ark.
- Explain how dinosaurs could have fit on the Ark.
- Measure your own cubit and tell how long the Ark was.

Warm-up. Bend your arm and measure from your elbow to the tip of your middle finger. That is your **cubit**! Noah's Ark was 300 cubits long. A grown-up's cubit is about 18 inches, so the Ark was about 450 feet long.

Video slot. Video coming. Noah's Ark for children: its size, the animals and the Ark Encounter full-size model. Search approved channels (Answers in Genesis Kids, Ark Encounter, Institute for Creation Research); preview first.

KEY TERMS

ark

The huge wooden boat God told Noah to build to save his family and the animals from the Flood.

cubit

An old measure: the length from the elbow to the tip of the middle finger, about 18 inches.

the Flood

The great flood in Noah's day that covered the whole earth (Genesis 6-9).

deck

A floor of a ship. The Ark had three.

CORE IDEAS

The story. Long after Adam and Eve, the earth "was filled with violence." People had turned away from God. "But Noah found grace in the eyes of the LORD" (Genesis 6:8). God told Noah to build an ark of wood, 300 cubits long, 50 cubits wide and 30 cubits high. That is longer than a football field and taller than a four-story building!

Who came aboard? God said that two of every kind of land animal and bird would "come unto thee, to keep them alive" (Genesis 6:20), and seven of some kinds. Noah did not have to chase the animals; God brought them. If dinosaurs were living on the land in Noah's day, then dinosaurs would have come too.

How could they fit? God did not ask for every variety, only every kind. Noah did not need a poodle and a wolf and a collie; two of the dog kind were enough. Dinosaurs have many names but fewer kinds. Also, many dinosaurs were not giants. Plenty were no bigger than a sheep. Even the biggest ones hatched from eggs about the size of a football. God may have

sent young dinosaurs, which were smaller, ate less and had many years ahead to have babies.

Inside the Ark. The Ark had three decks (Genesis 6:16), with room for animals, food and Noah's family. In Kentucky today there is a full-size model of the Ark called the Ark Encounter. Inside, it shows one way the animals, including young dinosaurs, might have been kept in pens on the decks.

Shut in safe. When everyone was aboard, "the LORD shut him in" (Genesis 7:16). The rain fell and the waters rose, but the Ark floated. Months later it came to rest "upon the mountains of Ararat" (Genesis 8:4). Then God told Noah to bring the animals out to fill the earth again. God keeps His people safe and keeps His promises.

PICTURE STUDY



Noah's Ark, Edward Hicks, 1846 · Oil on canvas · Philadelphia Museum of Art
Wikimedia Commons · CC0

Edward Hicks was a Quaker preacher and sign painter in Pennsylvania. He loved painting animals from the Bible. Here he shows the animals walking two by two into the Ark just before the rain begins.

Look closely

- Count the pairs of animals you can find.
- Find the ramp and the door of the Ark.
- Look at the sky. What is about to happen?

Talk about it

1. Hicks did not paint any dinosaurs. If you added a pair, where would you put them?

2. How do you think Noah's family felt as the animals came in?

HANDS-ON: A FLOATING FOIL ARK

Build a little ark with the same shape God gave Noah: 300 long, 50 wide, 30 high. Then see how much it can carry.

You will need

- Aluminum foil
- A ruler
- A sink, tub or large bowl of water
- Pennies or small toy animals

Steps

1. Make a box shape from doubled foil that is 30 centimeters long, 5 centimeters wide and 3 centimeters high. Each centimeter stands for 10 cubits.
2. Pinch the corners tight so no water can leak in.
3. Float your ark on the water.
4. Add pennies or toy animals one at a time, spreading them out evenly. Count how many your ark holds before it sinks.

Check your work

- My ark has the right shape: long, narrow and low.
- My ark floated.
- I can tell how long the Ark was in cubits and in feet.

FIELD NOTEBOOK

1. Draw the Ark from the side. Draw three decks inside and put a pair of dinosaurs on one deck.
2. Write: "300 cubits long, 50 cubits wide, 30 cubits high (Genesis 6:15)."

Did you know? The Ark's shape, six times longer than it is wide, is very steady in rough water. Big ships today often use a shape that is long and narrow too. The Ark Encounter in Williamstown, Kentucky, opened in 2016 and is 510 feet long.

Goes deeper in. Earth Science, the Flood unit, and Arithmetic, for measuring and scale (coming soon).

For families. The dimensions are from Genesis 6:15. At an 18-inch cubit the Ark is about 450 feet long; the Ark Encounter uses a longer cubit of about 20.4 inches, giving 510 feet. Creation researchers estimate the number of Ark "kinds" in the low thousands at most (Answers in Genesis has suggested fewer than 7,000 animals in all), far fewer than the number of named species; such estimates are hedged and debated. The claim that God

may have sent young animals is a common creationist suggestion, not a statement of Scripture, and the stop presents it as “may.” Some Christians hold a local-flood view; this course teaches a global Flood. Sauropod eggs were roughly 6–8 inches across.

PRACTICE

1. **EASY** How long was the Ark in cubits?
2. **MEDIUM** Why did Noah not need every variety of animal?
3. **MEDIUM** Give one reason the dinosaurs could fit on the Ark.

Make it a game • Two by Two. Draw pairs of animal cards (two lions, two Stegosaurus, two eagles, and so on), mix them up and lay them face down. Take turns flipping two cards. If they match, say “Two by two!” and march the pair into a shoebox ark. The game ends when every pair is safe inside.

Scripture. “Of fowls after their kind, and of cattle after their kind, of every creeping thing of the earth after his kind, two of every sort shall come unto thee, to keep them alive.” (Genesis 6:20, KJV)

God brought the animals to Noah to keep them alive. He cared for His creatures even in the Flood.

Practice: answers

1. 300 cubits (about 450 feet).
2. God asked for two of every kind, and one kind (like the dog kind) can later have many varieties.
3. Any one: many dinosaurs were small; God may have sent young ones; only kinds were needed, not every variety; the Ark was huge, with three decks.

2.5 FOSSIL GRAVEYARDS AND THE FLOOD

OBJECTIVES

- Tell why a bone must be buried quickly to become a fossil.
- Describe a fossil graveyard, like the bone wall at Dinosaur National Monument.
- Tell how many Christians connect fossil graveyards with Noah's Flood.

Warm-up. Think about an apple core left on the ground outside. What happens to it after a week? Bugs, birds and weather take it away. A dinosaur bone left on the ground would disappear too, unless something covered it up fast!

Video slot. Video coming. The dinosaur bone wall at Dinosaur National Monument (Quarry Exhibit Hall); how fossils form by quick burial. Search approved channels (National Park Service, Answers in Genesis Kids, Institute for Creation Research); preview first.

KEY TERMS

fossil

The hardened remains or traces of a living thing, kept in rock.

sediment

Mud, sand and little stones carried by water and laid down in layers.

fossil graveyard

A place where the bones of many animals are buried together in the rock.

quarry

A place where rock is dug out of the ground.

CORE IDEAS

The story. In August 1909, a fossil hunter named Earl Douglass was searching the dry hills of Utah for the Carnegie Museum in Pittsburgh. At the top of a rocky ledge he saw eight tail bones of a giant dinosaur lying in a row, just as they had been in the living animal. He wrote in his diary that it was "a beautiful sight." Douglass and his workers dug there for years.

A wall of bones. Today that place is called Dinosaur National Monument. Inside a building, visitors can see a tilted wall of rock with about 1,500 dinosaur bones still in it. The bones are jumbled together: Allosaurus, Stegosaurus, Apatosaurus, Diplodocus and more, many broken apart and mixed up. Not far away, at another quarry in Utah, workers have dug up more than 12,000 bones in one place.

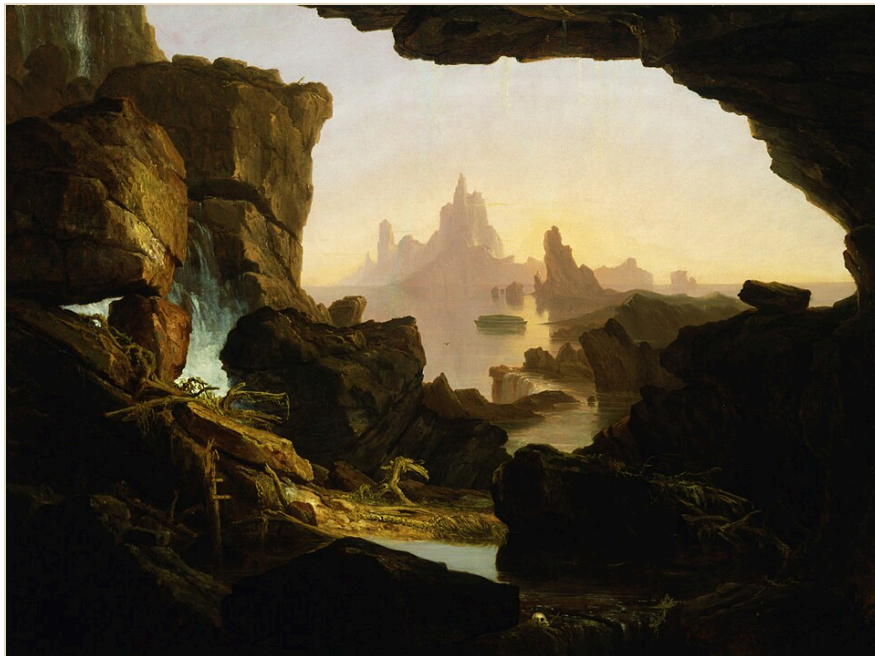
Buried fast. When an animal dies on open ground, it is usually eaten or rots away. To become a fossil, it must be covered quickly by mud or sand. Then, over time, minerals fill the

bone and harden it. A fossil graveyard shows that many animals were buried together, quickly, by water and **sediment**.

The Flood. The Bible says that in Noah's day "all the fountains of the great deep" broke open, and the waters covered even the high hills (Genesis 7:11, 19). Many creation geologists read fossil graveyards like these as made during the Flood year. Rushing water and mud could carry many animals, pile them together and bury them fast.

Another reading. The museum sign gives another explanation: a river flood long ago dropped the bones on a sandbar. Notice that both explanations agree on what we can see: water and sand buried many dinosaurs quickly. They disagree about when and how big the flood was. Read the ⌚ box below to sort it out.

PICTURE STUDY



The Subsiding of the Waters of the Deluge, Thomas Cole, 1829 · Oil on canvas · Smithsonian American Art Museum, Washington, D.C.
Wikimedia Commons · Public domain

Thomas Cole was a famous American painter of mountains and wild places. In this painting he imagined the end of the Flood, when the waters were going down and the sun was breaking through the clouds.

Look closely

- Look far away on the water. Can you find the Ark?
- Find the brightest part of the sky. Where is the darkest part of the picture?
- Look at the rocks. Do they look smooth or broken and rough?

Talk about it

1. How does this picture make you feel: afraid, sad or hopeful? Why?
2. What do you think would be buried under the mud when the waters went down?

HANDS-ON: FLOOD IN A JAR

See how moving water sorts mud and sand into layers and buries “bones” fast.

You will need

- A clear plastic jar with a tight lid
- A cup of mixed garden soil, sand and small pebbles
- Six pieces of dry pasta (your “bones”)
- Water

Steps

1. Put the soil, sand, pebbles and pasta bones into the jar.
2. Fill the jar almost to the top with water and screw the lid on tight.
3. Shake the jar hard for ten seconds, like a rushing flood, then set it down.
4. Watch for five minutes, then again the next day. Draw the layers. Where did the pasta bones end up?

Check your work

- I saw the jar settle into layers.
- I found at least one pasta bone buried in the sediment.
- I can tell why fossils need quick burial.

FIELD NOTEBOOK

1. Draw your Flood jar the next day. Label the layers: pebbles, sand, mud, water. Mark where the bones are.
2. Draw part of the bone wall at Dinosaur National Monument, with bones of different shapes mixed together.

Did you know? Earl Douglass hoped the bone quarry would be kept so people could see the bones right where they were found. In 1915 it became Dinosaur National Monument, and today the bone wall is still inside a building, just as he hoped.

 **What the sign says / What we observe / How Christians read it.**  **What the sign says:** “These dinosaurs lived about 150 million years ago, in the Late Jurassic. A river in flood carried their bodies and dropped them on a sandbar.” **What we observe:** about 1,500 bones of many kinds of dinosaurs are mixed together in one layer of sandstone; many are broken apart and jumbled; the sand was laid down by moving water, and the bones were buried before they could rot away. **How Christians read it:** many young-earth Christians read fossil graveyards like this one as laid down quickly in Noah’s Flood, only thousands of years ago. Other Christians accept the sign’s dates and still trust

the Bible. Everyone agrees on the observation: water and sand buried many dinosaurs fast. “Jurassic” is a museum word for a set of rock layers, not a date anyone watched.

Goes deeper in. Earth Science, the fossils and Flood units, and Trail D, Stop D7 “What happened to the dinosaurs?” (coming soon).

For families. This is a ⌚ stop. Earl Douglass found the site on August 17, 1909, working for the Carnegie Museum; his diary describes eight Apatosaurus (then “Brontosaurus”) tail vertebrae “in exact position” and adds, “It was a beautiful sight.” The quarry was worked until 1924 and the monument was proclaimed in 1915. The National Park Service says the Quarry Exhibit Hall wall shows about 1,500 bones, in the Morrison Formation, and interprets the site as a river sandbar. The Cleveland-Lloyd Dinosaur Quarry (Utah) has yielded more than 12,000 bones, mostly Allosaurus. Many creationists date the Flood to roughly 4,300–4,500 years ago; the stop says “thousands of years.”

PRACTICE

1. **EASY** What must happen to a bone quickly for it to become a fossil?
2. **EASY** What is a fossil graveyard?
3. **MEDIUM** What do the museum sign and many creation geologists agree on about the bone wall?

Make it a game · Bone Quarry Dig. A grown-up buries pasta “bones” of different shapes in a sandbox or a tub of rice. Players dig with spoons and paintbrushes, gently, like real fossil hunters. Sort the bones into piles by shape. Who can find the most without breaking any?

Scripture. “And the waters prevailed exceedingly upon the earth; and all the high hills, that were under the whole heaven, were covered.” (Genesis 7:19, KJV)

The Flood was not a little rain. The waters covered the whole earth, and many Christians see its work still written in the rocks.

Practice: answers

1. It must be buried quickly by mud or sand.
2. A place where bones of many animals are buried together in the rock.
3. That water and sand buried many dinosaurs quickly. They disagree about when and how big the flood was.

2.6 DRAGON LEGENDS WORLDWIDE

OBJECTIVES

- Name three places in the world that have old dragon stories.
- Tell two ideas about where dragon stories came from.
- Tell the difference between a legend and true history.

Warm-up. Take one minute and draw a dragon as fast as you can. What did you give it? Scales? A long tail? Sharp teeth? Wings? Now look at a picture of a dinosaur. Which parts are the same?

Video slot. Video coming. Dragon legends around the world for children; Saint George and the dragon; Chinese dragon dances. Search approved channels (Answers in Genesis Kids, The National Gallery London, Smithsonian); preview first.

KEY TERMS

legend

An old story passed down for a long time. It may have some truth in it, but parts have grown or changed.

dragon

A great scaly creature with a long tail found in old stories all over the world. The King James Bible also uses the word.

Saint George

A real Christian soldier who died for his faith long ago. A famous legend says he fought a dragon.

Beowulf

A very old English poem about a hero who fights monsters and, at the end, a dragon (say “BAY-uh-wulf”).

CORE IDEAS

The story. Long ago in China, people told stories of long, scaly dragons that lived near rivers and clouds. Today, dragon dancers still wind through the streets at Chinese New Year. Far away in England, people told how Saint George rescued a princess from a dragon. The country of Wales has a red dragon on its flag. And an old English poem called *Beowulf* ends with a fire-breathing dragon guarding a pile of treasure.

All over the world. People in Asia, Europe, Africa and the Americas told dragon stories. Many of these people never met each other. Yet their dragons are often alike: big, scaly reptiles with long tails, sharp teeth and great strength. Isn’t that interesting? Why would people so far apart tell such similar stories?

Where did dragons come from? Many creation Christians think that after the Flood, people may have seen some living dinosaurs or other great reptiles, and the stories grew bigger each time they were told, adding wings or fire. Other people think that long ago, folks dug up huge fossil bones and imagined what creature they came from. Some dragon stories were probably just made up. The answer may be a little of each.

Dragons in the Bible. The King James Bible uses the words “dragon” and “dragons” more than thirty times. Psalm 148 calls on the dragons to praise the Lord. The Hebrew word behind it can mean a great sea creature, a serpent or a wild desert animal. In Revelation, “the dragon” is a picture of Satan, God’s enemy, who is finally defeated.

Legend or history? A legend may hold a seed of truth. Saint George was a real Christian soldier who died for his faith about 1,700 years ago, but the dragon part of his story was added hundreds of years later. The Bible is different: it is true history, not legend. When you hear an old story, a wise reader asks, “What is the true part?”

PICTURE STUDY



Saint George and the Dragon, Paolo Uccello, About 1470 · Oil on canvas · The National Gallery, London
Wikimedia Commons · Public domain

Paolo Uccello was an Italian painter who loved shapes and patterns. He painted the legend of Saint George as a calm, almost fairy-tale scene. Notice that the lady is not running away at all!

Look closely

- Look at the dragon’s wings. What shapes did Uccello paint on them?
- Find the cord in the lady’s hand. Where does it go?
- Find the swirling cloud in the sky. Which way does it point?

Talk about it

1. Does Uccello's dragon look more like a dinosaur, a bat or a lizard? Why?
2. Why might people have liked telling stories of a brave hero who fights a dragon?

HANDS-ON: MY DRAGON LEGENDS MAP

Make a map that shows how many places in the world told dragon stories.

You will need

- A printed world map or a map you trace from a globe
- Crayons or colored pencils
- Small paper dragons you cut out (with a grown-up's help with scissors)
- Glue stick

Steps

1. Find China on the map and glue a long, wiggly dragon there.
2. Find England and Wales. Glue a dragon there for Saint George and the red dragon of Wales.
3. Find Denmark and Sweden, where the story of Beowulf takes place, and glue a dragon there.
4. Color the oceans blue. Count your dragons and talk about how far apart these places are.

Check your work

- My map has at least three dragons in different places.
- I can name the story that goes with each dragon.
- I can tell two ideas about where dragon stories came from.

FIELD NOTEBOOK

1. Draw a dragon from a legend on one side of a page and a real dinosaur on the other. Circle the parts that are alike.
2. Copy Psalm 148:7.

Did you know? Saint George is the patron saint of England, and his red cross on a white flag is the flag of England. The dragon on the flag of Wales is called *Y Ddraig Goch* (say "uh THRYG gawkh"), which means "the red dragon" in Welsh.

Goes deeper in. Literature, for legends and *Beowulf*; History, for the early Church and the martyrs; and Geography, for the map (coming soon).

For families. George was a soldier martyred around 303 under Diocletian; the dragon episode appears in sources from roughly the 11th-12th centuries and was spread by the

Golden Legend (about 1260). *Beowulf* survives in a manuscript from about AD 1000; the poem's date of composition is debated. The red dragon became the official flag of Wales in 1959. The KJV count ("dragon" and "dragons" together, about 35 times) translates mainly Hebrew *tannin/tannim* and Greek *drakon*; modern versions often render some as "jackals" or "serpent." The fossil idea is argued by historian Adrienne Mayor (*The First Fossil Hunters*, 2000). Claimed dinosaur carvings on old buildings and tombs are disputed and are left out here.

PRACTICE

1. **EASY** Name two places that have old dragon stories.
2. **MEDIUM** Give one idea about where dragon stories came from.
3. **MEDIUM** What is a legend?

Make it a game • Catch the Dragon's Tail. Players line up, each holding the waist or shoulders of the one in front, to make a long dragon. The first player is the head; the last player is the tail. The head tries to tag the tail while the whole dragon stays connected. If the dragon breaks apart or the head tags the tail, the head goes to the back and becomes the new tail. Play on soft grass and move gently.

Scripture. "Praise the LORD from the earth, ye dragons, and all deeps:" (Psalm 148:7, KJV)

Even the greatest creatures, the "dragons" and the deep sea, are called to praise the God who made them.

Practice: answers

1. Any two: China, England, Wales, Denmark and Sweden (*Beowulf*), or other places around the world.
2. Any one: people saw living dinosaurs or great reptiles after the Flood; people found fossil bones and imagined the creature; some stories were simply made up.
3. An old story passed down that may have some truth in it but has grown or changed over time.

2.7 WHAT HAPPENED TO THE DINOSAURS? EACH VIEW

OBJECTIVES

- Tell what “extinct” means and name an animal that went extinct in recent history.
- Tell the asteroid view and the creation view of what happened to the dinosaurs.
- Name two clues that scientists observe.

Warm-up. Name an animal that you could never see alive at a zoo, because there are none left anywhere. Did you think of a mammoth? A dodo? A T. rex? Animals like these are **extinct**.

Video slot. Video coming. What happened to the dinosaurs? The asteroid view and the Flood view for children; the dodo. Search approved channels (Answers in Genesis Kids, Institute for Creation Research, Natural History Museum London); preview first.

KEY TERMS

extinct

Gone forever: no more of that kind of animal or plant are alive anywhere.

asteroid

A big rock flying through space. A small one that hits the earth is called a meteorite.

crater

A round hole or bowl in the ground made when something big crashes into it.

dodo

A large bird that could not fly. It lived on an island in the Indian Ocean and went extinct about 350 years ago.

CORE IDEAS

The story. On the island of Mauritius, in the Indian Ocean, there once lived a big gray bird called the dodo. It could not fly, and it had no reason to be afraid. Then, in 1598, sailors from Holland landed on the island. Ships brought rats and pigs that ate the dodos’ eggs, and hungry sailors hunted the birds. In less than a hundred years, the dodo was gone. People saw it, wrote about it and drew it, but no one will ever see a living dodo again.

The dinosaur mystery. No one alive today has seen a living T. rex either. What happened? Scientists look for clues. They observe that dinosaur bones are found in some rock layers but not in the layers above them. In many places around the world there is a thin layer of clay with a rare metal called iridium, which is common in space rocks. And under the ground in Mexico there is a huge buried **crater**, about 110 miles across.

View one: the asteroid. Most museum signs say that a giant asteroid crashed into Mexico about 66 million years ago. Dust and smoke filled the sky and blocked the sun, plants died,

and the dinosaurs starved. Some scientists think huge volcanoes in India helped too. Many scientists hold this view, and so do many Christians who believe the earth is very old.

View two: the Flood and after. Many young-earth Christians say that most dinosaurs died in Noah's Flood and were buried in the rock layers. The dinosaurs on the Ark came out afterward (Genesis 8:17). But the world after the Flood was harder: colder in places, with less food, and with people hunting. One by one the dinosaur kinds died out, the way the dodo did. Some creation scientists think big space rocks hit the earth during the Flood year, so the crater in Mexico could fit this view too.

What every view agrees on. The dinosaurs are gone, God made them, and death is part of a world broken by sin (Genesis 3). The Bible says "the whole creation groaneth" and waits for the day when Jesus will set it free. One day He will say, "Behold, I make all things new" (Revelation 21:5).

PICTURE STUDY



Iguanodon and Megalosaurus, from The World Before the Deluge, Édouard Riou, 1863 · Wood engraving · From Louis Figuier, La Terre avant le déluge (Paris, 1863), in English The World Before the Deluge Wikimedia Commons · Public domain

Édouard Riou was a French artist who also drew pictures for Jules Verne's adventure books. He made this picture for a book called *The World Before the Deluge*. "Deluge" is an old word for the Flood. Scientists in 1863 knew only a few dinosaur bones, so Riou drew the dinosaurs looking like giant lizards.

Look closely

- Find the two dinosaurs. How are they standing: on two legs or four?
- Look at the trees and plants. Do they look like the ones near your home?

- Find something in the picture that we now know is not quite right about dinosaurs.

Talk about it

1. The book's title is "The World Before the Deluge." What does that title tell you about how people talked about dinosaurs then?
2. Why do pictures of dinosaurs change as people find more bones?

HANDS-ON: MAKE A CRATER

See what a crater looks like and what clues it leaves behind.

You will need

- A baking pan
- Flour (about 2 inches deep)
- A spoonful of cocoa powder
- Three different-sized round stones or marbles
- Newspaper under the pan

Steps

1. Spread the flour smooth in the pan. Sprinkle a thin layer of cocoa on top.
2. Hold the smallest stone up high and drop it into the flour. Look at the shape it makes.
3. Drop the bigger stones. Look for the round bowl and the white flour thrown out on top of the brown cocoa.
4. Talk about it: what clues would a crater leave for a scientist to find later? Which view of the dinosaurs uses the crater, and how?

Check your work

- I made at least three craters.
- I can tell what a crater is.
- I can tell both views of what happened to the dinosaurs.

FIELD NOTEBOOK

1. Make two columns: "View one: the asteroid" and "View two: the Flood and after." Draw a picture and write one sentence in each.
2. Draw a dodo and write: "Extinct by about 1690."

Did you know? The buried crater in Mexico is called Chicxulub (say "CHEEK-shoo-loob"), after a small town near it. Much of it lies under the sea and under the ground, so you cannot see it from a plane. Scientists found it by measuring the rocks deep underground.

 **What the sign says / What we observe / How Christians read it.**  **What the sign says:** “About 66 million years ago, at the end of the Cretaceous Period, a giant asteroid struck Earth and the dinosaurs died out.” **What we observe:** dinosaur bones are found in some rock layers but not in the layers above; a thin clay layer rich in iridium is found in many places; a huge crater about 110 miles wide is buried in Mexico; and animals like the dodo have gone extinct in recorded history. **How Christians read it:** many young-earth Christians say most dinosaurs were buried in Noah’s Flood, thousands of years ago, and the rest died out afterward in a harder world; some think the crater was made during the Flood year. Many Christians who hold an old earth accept the asteroid view. Everyone agrees on the clues; they read them in different ways. “Cretaceous” is a museum word for a set of rock layers.

Goes deeper in. Earth Science, the Flood and Ice Age units; Life Science, for extinction; and Trail E, Stops E6–E8, for Ice Age animals (coming soon).

For families. This is a  stop. The impact hypothesis was proposed by Luis and Walter Alvarez and colleagues in *Science* (1980), based on the iridium layer; the Chicxulub crater (about 180 km, or 110 miles, across) was linked to it around 1991. The Deccan Traps volcanism in India is the main alternative or added cause in mainstream science. Young-earth views vary: many see most dinosaur fossils as Flood burials and post-Flood extinction for the rest; some creation geologists place large impacts within the Flood year. Many museums teach that birds are living dinosaurs; creation scientists hold that birds were made separately on day five. Dutch sailors reached Mauritius in 1598; the last widely accepted dodo sighting was in 1662, and extinction is usually placed by about 1690.

PRACTICE

1.  What does “extinct” mean?
2.  Tell the asteroid view in one sentence.
3.  Tell the young-earth creation view in one or two sentences.

Make it a game • Clue Detectives. A grown-up hides three clue cards around the room: “A buried crater,” “A clay layer with a space metal,” and “Bones in some layers but not above.” Players hunt for them. When a clue is found, the finder reads it aloud and tells how the asteroid view explains it and how the Flood view explains it.

Scripture. “For we know that the whole creation groaneth and travaileth in pain together until now.” (Romans 8:22, KJV)

Animals die and kinds go extinct because the world is broken by sin. But God has promised to make all things new.

Practice: answers

1. Gone forever: none of that kind are alive anywhere.
2. A giant asteroid hit Mexico, dust blocked the sun, plants died and the dinosaurs starved.
3. Most dinosaurs died and were buried in Noah's Flood. The ones from the Ark died out later in a harder world, the way the dodo did.

2.8 READING A MUSEUM SIGN

OBJECTIVES

- Find the parts of a museum sign: name, where found, size, food and date.
- Read the museum words Triassic, Jurassic and Cretaceous and say what they name.
- Rewrite a museum sign so it keeps observations and interpretations apart.

Warm-up. Pick up a cereal box. Find something on it you could check for yourself, like the weight. Now find something that is only someone's opinion, like "Tastes great!" Museum signs have both kinds of words too.

Video slot. Video coming. A family museum visit: reading dinosaur exhibit signs; Triceratops skeletons. Search approved channels (Answers in Genesis Kids, Institute for Creation Research museum guides, Field Museum, Smithsonian); preview first.

KEY TERMS

museum

A building where real objects, like fossils and paintings, are kept and shown so people can learn.

label

The small sign beside a museum object that tells what it is.

period name

A museum word, like Jurassic or Cretaceous, used to name a set of rock layers.

interpretation

An explanation of what something means. It can be checked and talked about, but it is not the same as what we see.

CORE IDEAS

The story. Picture yourself walking into a big museum hall. In the middle stands a giant skeleton with a bony frill and three sharp horns. Beside it is a sign: *TRICERATOPS HORRIDUS. "Three-horned face." Late Cretaceous Period, 68 to 66 million years ago. Found in Montana, Wyoming and the Dakotas. Length: about 30 feet. Diet: plants.* What can a young dinosaur hunter learn from this sign?

Part by part. The **name** comes from old Greek: *tri* means three, *cera* means horn and *tops* means face. **Where it was found** is something people saw: they dug these bones out of the ground. The **size** was measured with a tape. The **diet** is a good clue from the teeth, which were made for slicing plants. These parts rest on things people can see and measure.

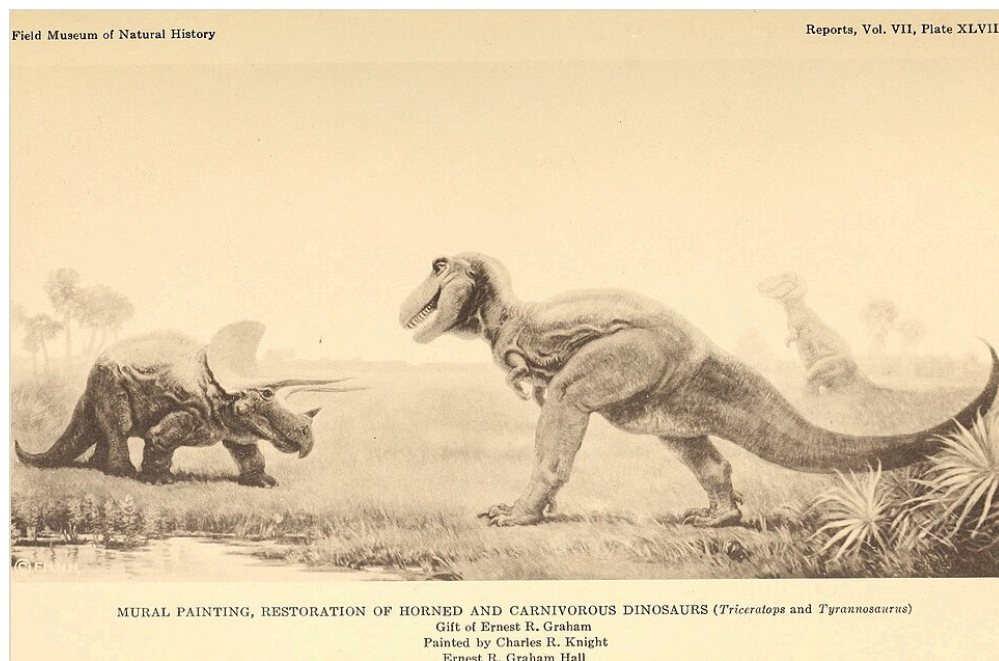
Museum words. Signs often use **period names**: Triassic, Jurassic and Cretaceous. These are names for sets of rock layers, a little like chapter titles in a book. "Jurassic" comes from

the Jura Mountains in France and Switzerland. “Cretaceous” comes from the Latin word for chalk. Learn these words so you can read any sign. But a name for a layer is not a date that anyone watched.

The date. “68 to 66 million years ago” is different. No one was there to see a living Triceratops and write down the year. The date comes from measuring rocks and making guesses about the past. That makes it an **interpretation**. Many Christians read the same bones as buried in Noah’s Flood only thousands of years ago. When a sign says a dinosaur “evolved from” another, that is an interpretation too.

Kind and careful. Museum workers dig in the hot sun, clean bones grain by grain and build skeletons with great skill. Thank God for their hard work, and never mock them. Then read like the people of Berea in the Bible, who listened gladly but also “searched the scriptures daily, whether those things were so” (Acts 17:11).

PICTURE STUDY



Tyrannosaurus and Triceratops, from the Field Museum murals, Charles R. Knight, 1926-1930 (mural series) · Oil on canvas (mural) · Field Museum, Chicago
Wikimedia Commons · Public domain

Charles R. Knight painted a set of huge pictures for the walls of the Field Museum in Chicago, so visitors could imagine fossils as living animals. Paintings like this are part of what a museum shows, just like the signs. Knight worked closely with scientists and studied real bones before he painted.

Look closely

- Find the three horns on the Triceratops. Which way is it facing?
- Look at the Tyrannosaurus. How is it standing?

- Look at the land and the sky. What season or weather do you think it is?

Talk about it

1. Which things in this painting could the artist learn from the bones, and which did he have to imagine?
2. If you wrote a museum label for this painting, what would you put on it?

HANDS-ON: MUSEUM SIGN REWRITE

Write your own museum sign that is honest about what we see and what people think.

You will need

- An index card or half a sheet of paper
- Two colored pencils (for example, green and orange)
- A dinosaur toy, model or picture
- The sample Triceratops sign in the story, or a real sign from a museum website

Steps

1. Copy the sample sign. Underline the parts people can see or measure in green and the explanations in orange.
2. On a new card, write a sign for your own dinosaur. At the top write its name and what the name means.
3. Under the heading “What we observe,” write two facts: where it was found, its size or its teeth.
4. Under the heading “What people think,” write one interpretation, and add how many Christians read it. Stand your sign beside your dinosaur like a real museum.

Check your work

- My sign has a name, two observations and one interpretation.
- I used the right colors on the sample sign.
- I can say what the word “Cretaceous” names.

FIELD NOTEBOOK

1. Paste or copy your museum sign into your Field Notebook, with a drawing of your dinosaur beside it.
2. Write the three museum words in order from the lowest layers: Triassic, Jurassic, Cretaceous.

Did you know? Triceratops is one of the most common dinosaurs found in Montana and the Dakotas. Its skull alone could be longer than a grown-up is tall. Its frill was solid bone, and its horn cores were covered in life with a hard sheath, like a cow’s horn.

 **What the sign says / What we observe / How Christians read it.**  **What the sign says:** “Triceratops horridus. Late Cretaceous Period, 68 to 66 million years ago.”

What we observe: Triceratops bones are dug from certain rock layers in Montana, Wyoming and the Dakotas; the skeleton is about 30 feet long; the teeth are shaped for slicing plants. **How Christians read it:** many young-earth Christians read these layers as laid down in Noah’s Flood, only thousands of years ago, and treat “Cretaceous” as a name for the layers, not a date. Other Christians accept the sign’s dates. A good reader keeps the observations and the interpretations apart and treats the museum workers with respect.

Goes deeper in. Earth Science, the rock layers and dating units; Literature, for careful reading; and Trail D, Stop D9 “Soft tissue and dating” (coming soon).

For families. This is a  stop. *Triceratops horridus* was named by O. C. Marsh in 1889; its fossils come mainly from the Hell Creek and Lance Formations. Adult length estimates run about 26–30 feet. The sample sign is a composite in the style of real museum labels, not a quotation. “Jurassic” comes from the Jura Mountains; “Cretaceous” from Latin *creta*, chalk (named by d’Omalius d’Halloy, 1822); “Triassic” from the three-part layering in Germany (von Alberti, 1834). The stop teaches period names as museum vocabulary and the dates as interpretations, without mocking museum staff. Charles R. Knight died in 1953; the Field Museum murals were painted 1926–1930.

PRACTICE

1.  What does “Triceratops” mean?
2.  On a museum sign, is “Found in Montana” an observation or an interpretation?
3.  What does a period name like “Jurassic” name?

Make it a game · Museum Guide. One player is the museum guide and stands beside a toy dinosaur with a homemade sign. The guide reads the sign aloud. After each sentence the visitors ask, “How do you know?” If the guide can say “We can see it” or “We measured it,” the visitors clap once. If the answer is “That is what people think,” the visitors touch their chins. Take turns being the guide.

Scripture. “These were more noble than those in Thessalonica, in that they received the word with all readiness of mind, and searched the scriptures daily, whether those things were so.” (Acts 17:11, KJV)

The Bereans listened gladly and then checked what they heard. We can read every sign with a ready mind and a careful eye.

Practice: answers

1. “Three-horned face.”
2. An observation: people dug the bones out of the ground there.

3. A set of rock layers. It is a museum word, not a date anyone watched.

2.9 SOFT TISSUE AND DATING

OBJECTIVES

- Tell the three “ifs” every rock-clock date depends on.
- Explain why soft tissue in dinosaur bones surprised scientists.
- Tell two ways people read the soft tissue finds.

Warm-up. Watch a sand timer or an egg timer. If you walked into the room halfway through, could you tell how long it had been running? Only if you knew how much sand was in the top at first and how fast it falls!

Video slot. Video coming. How scientists date rocks, explained simply with an hourglass; soft tissue in dinosaur bones. Search approved channels (Answers in Genesis Kids, Institute for Creation Research, Creation Ministries International, Smithsonian); preview first.

KEY TERMS

dating

Working out how old something is.

assumption

Something we take to be true without being able to check it, because no one was there to see.

rate

How fast something happens, like how many drops fall each minute.

protein

A tiny building block of living bodies. Proteins in skin, muscle and bone slowly break down after an animal dies.

CORE IDEAS

The story. Imagine you come into the kitchen and find a candle burning on the table. It is two inches tall. How long has it been burning? To answer, you need to know three things. How tall was it at the start? How fast does it burn? Did anyone blow it out and light it again? You were not there, so you have to make guesses. Those guesses are called **assumptions**.

Rock clocks. Scientists date some rocks in a way that works a little like that candle or an hourglass. Certain tiny bits in volcanic rock slowly change into other kinds, like sand falling from the top of a timer to the bottom. Scientists measure how much is in the “top” and “bottom” today and figure backward. They usually date layers of volcanic ash near the bones, not the bones themselves.

The three ifs. A rock-clock date is only right *if* we know how much was there at the start, *if* the change always went at the same **rate**, and *if* nothing was added or taken away. No one can go back and check those three things. That is why this course calls the dates interpretations.

A soft surprise. In Stop B10 you met Mary Schweitzer, who found soft, stretchy material inside a T. rex bone. Since then, other scientists have reported soft tissue or bits of **protein** in more dinosaur bones. This surprised many people, because proteins break down over time. In the lab, they fall apart much faster than millions of years.

Two ways of reading it. Many young-earth Christians say soft tissue fits bones that are only thousands of years old, and it is a hint that the three “ifs” may not hold. Many other scientists say something in the bone, like iron, kept the tissue safe for millions of years. Both sides keep testing. And all of us can remember what God asked Job: “Where wast thou when I laid the foundations of the earth?” God was there. We were not.

PICTURE STUDY



Cork cells, Scheme XI from Micrographia, Robert Hooke, 1665 · Engraving · From Micrographia, published in London for the Royal Society
Wikimedia Commons · Public domain

Robert Hooke was an English scientist who built a microscope and drew what he saw. When he looked at a thin slice of cork, he saw tiny boxes and called them “cells,” like the small rooms where monks lived. Scientists who study soft tissue in dinosaur bones look for tiny shapes like cells too.

Look closely

- Find the slice marked B. Count the tiny boxes in one row.

- Find the slice marked A. How are its holes different from the boxes in B?
- Look for the small plant at the bottom. Why do you think Hooke put it there?

Talk about it

1. Why is it important to draw exactly what you see under a microscope, and not what you expect?
2. What would you like to look at under a microscope?

Safety first. A grown-up makes the hole in the cup with a pushpin or thumbtack and puts it away right after.

HANDS-ON: THE DRIP CLOCK

Make a water clock and find out what happens to a date when one of the three “ifs” goes wrong.

You will need

- A paper or plastic cup
- A pushpin (for a grown-up)
- A clear glass or jar
- A marker and a measuring cup
- A timer or clock

Steps

1. A grown-up pokes one small hole in the bottom of the cup. Set the cup on top of the clear jar.
2. Pour in one cup of water and start the timer. After 5 minutes, mark the water line on the jar.
3. Now play detective: a grown-up secretly empties the jar, sets it dripping again, and partway through pours in a little extra water. Come back, look at the water line and guess how many minutes it has been running.
4. Was your guess right? Which “if” went wrong: the starting amount, the rate, or something added?

Check your work

- My drip clock dripped into the jar.
- I made a guess and checked it.
- I can name the three “ifs.”

FIELD NOTEBOOK

1. Draw an hourglass. Next to it, write the three “ifs”: the starting amount, a steady rate, nothing added or taken away.

2. Copy Job 38:4.

Did you know? Robert Hooke's book *Micrographia* was the first big book of drawings made through a microscope. It showed a flea and a fly's eye so large that people were amazed. Hooke is the person who first used the word "cell" for the tiny parts of living things.

 **What the sign says / What we observe / How Christians read it.**  **What the sign says:** "This Tyrannosaurus is about 68 million years old, dated by the volcanic ash layers above and below it." **What we observe:** scientists measure the amounts of certain elements in ash layers today; soft, stretchy tissue and traces of protein have been reported inside some dinosaur bones; in the lab, proteins break down over time. **How Christians read it:** many young-earth Christians say the dates depend on three assumptions that cannot be checked, and that soft tissue fits bones only thousands of years old. Other scientists, including some Christians, think iron or minerals preserved the tissue for millions of years. Both keep testing; the observations are the part everyone shares.

Goes deeper in. Earth Science, the dating unit; Life Science, for cells and microscopes; and Trail B, Stop B10 "Mary Schweitzer's soft tissue" (coming soon).

For families. This is a  stop, simplified for ages 7-9. Dinosaur-bearing layers are usually dated by radiometric methods (for example argon-argon) on volcanic ash beds, not on the bones. Soft tissue: Schweitzer et al., *Science* (2005); protein sequences from a Brachylophosaurus (2009); structures like red blood cells in eight Natural History Museum specimens (Bertazzo et al., *Nature Communications*, 2015); the iron-preservation hypothesis (Schweitzer et al., 2014). Some creation researchers have reported carbon-14 in dinosaur bones; most scientists attribute this to contamination. These claims are left out of the child's text. Hooke's *Micrographia* was published in 1665; the cork drawing is Observation XVIII, Scheme XI.

PRACTICE

1.  **EASY** What is an assumption?
2.  **MEDIUM** Name the three "ifs" behind a rock-clock date.
3.  **MEDIUM** Why did soft tissue in dinosaur bones surprise scientists?

Make it a game • Bean Clock. Put 30 beans in a cup. Each time the leader claps, a player moves 2 beans into a bowl. One player leaves the room while the others clap a few times. The player comes back, counts the beans in the bowl and guesses how many claps there were. Next round, the leader secretly drops a few extra beans in the bowl first. Does the guess still work? Talk about which "if" went wrong.

Scripture. "Where wast thou when I laid the foundations of the earth? declare, if thou hast understanding." (Job 38:4, KJV)

No scientist was there at the beginning, but God was. We measure carefully, and we trust the One who saw it all.

Practice: answers

1. Something we take to be true but cannot check, because no one was there.
2. We know the starting amount; the rate stayed the same; nothing was added or taken away.
3. Because proteins and soft tissue break down over time, and many expected nothing soft to last that long.

2.10 FEARFULLY MADE: DESIGN IN DINOSAURS

OBJECTIVES

- Name three designs God built into dinosaurs.
- Tell what the word “dinosaur” means and how it connects to Psalm 139.
- Say Psalm 139:14 and tell what it means.

Warm-up. Run your tongue over your teeth. If you lose a baby tooth, a grown-up tooth grows in its place, but only once. Some dinosaurs got brand-new teeth again and again, all their lives!

Video slot. Video coming. Design in dinosaurs for children: hollow sauropod neck bones, duck-bill tooth batteries and dinosaur eggshells. Search approved channels (Answers in Genesis Kids, Institute for Creation Research, Creation Ministries International); preview first.

KEY TERMS

design

A plan that makes something fit its job well. A design points to a designer.

air sac

A balloon-like bag of air in the body that helps with breathing. Birds have them, and some dinosaurs did too.

tooth battery

Rows and stacks of teeth packed together, with new teeth ready below the old ones.

pore

A tiny hole. Eggshells have pores that let air in.

CORE IDEAS

The story. In 1842 an English scientist named Richard Owen made up the word “dinosaur.” He built it from two Greek words: *deinos*, meaning terrible or “fearfully great,” and *sauros*, meaning lizard. King David used the same idea of awe long before, when he prayed, “I am fearfully and wonderfully made.” Dinosaurs fill us with wonder, and so does the God who made them.

Light, strong necks. How could a Brachiosaurus hold up a neck as long as a giraffe and a half? God made its neck bones with hollow spaces inside, filled with air from **air sacs**, the way many bird bones are today. The bones were strong where they needed strength and light everywhere else, like a steel bridge with holes in its beams. Scientists can see these hollow spaces in the fossil bones.

Teeth that never ran out. Duck-billed dinosaurs, like Edmontosaurus, ate tough plants all day long. Their jaws held a **tooth battery**: hundreds of teeth packed tightly in rows, with new teeth stacked underneath, ready to move up as the old ones wore away. Together they made a grinding surface like a rough file.

Eggs that breathe. A baby dinosaur grew inside a hard eggshell. But a baby needs air! God made the shells with tiny **pores**, holes too small to see, so air could come in and water could slowly go out, just like a chicken egg today. Scientists have studied these pores in fossil dinosaur eggshells.

A Designer. When you see a bridge, you know someone planned it. Paul wrote that God's "eternal power and Godhead" are "clearly seen, being understood by the things that are made" (Romans 1:20). Hollow bones, endless teeth and breathing eggs all point to the great Designer. And He made you too: fearfully and wonderfully.

PICTURE STUDY



Leaping Laelaps, Charles R. Knight, 1897 · Painting · American Museum of Natural History, New York
Wikimedia Commons · Public domain

Charles R. Knight painted this picture with help from the fossil hunter Edward Drinker Cope. Most people then pictured dinosaurs as slow and heavy, but Knight showed them leaping and quick, full of life. Today this dinosaur is called *Dryptosaurus*.

Look closely

- Find the dinosaur in the air. What is it doing with its feet?
- Look at the other dinosaur's tail and legs. Is it ready to get up?
- Look at the colors. Where is the light coming from?

Talk about it

1. What parts of these dinosaurs look designed for speed and strength?
2. Why do you think Knight painted the dinosaurs moving instead of standing still?

HANDS-ON: LIGHT BUT STRONG

Find out why a hollow bone can be light and still strong.

You will need

- Four sheets of plain paper
- Tape
- Several small books

Steps

1. Lay one flat sheet of paper across the gap between two books standing a hand apart. Set a small book on it. What happens?
2. Roll three sheets of paper into tubes about as thick as your thumb, and tape them closed.
3. Stand the three tubes up and gently lay a book on top. Add more books, one at a time. Count how many they hold.
4. Talk about it: the tubes are hollow, but they are strong. How does this help a long-necked dinosaur?

Check your work

- I tested flat paper and paper tubes.
- I counted how many books my tubes held.
- I can name three designs God built into dinosaurs.

FIELD NOTEBOOK

1. Draw three boxes. In each, draw one design: a hollow neck bone, a tooth battery and an egg with tiny pores. Label each.
2. Copy Psalm 139:14 in your best handwriting.

Did you know? The dinosaur in Knight's painting was first named *Laelaps* by Cope. But the name had already been given to a tiny mite, so in 1877 O. C. Marsh gave it a new name: *Dryptosaurus*, "tearing lizard."

Goes deeper in. Life Science, for bones, teeth and eggs; Art, for Charles R. Knight; and Trail C, "How Dinosaurs Lived" (coming soon).

For families. Owen coined "Dinosauria" in 1842 from Greek *deinos* and *sauros*, explaining it as "fearfully great lizard"; the link to Psalm 139:14 is a teaching connection,

not a claim that Owen had the psalm in mind. Hollow, air-filled (pneumatic) vertebrae in sauropods are well documented and linked to bird-like air sacs. Hadrosaur dental batteries held hundreds of teeth in use and in reserve. Fossil dinosaur eggshells show gas-exchange pores. Knight painted *Leaping Laelaps* in 1897 for the American Museum of Natural History, guided by Cope; Knight died in 1953. Design is presented as Romans 1:20 presents it, as something clearly seen in creation.

PRACTICE

1. **EASY** What does the word “dinosaur” mean?
2. **MEDIUM** How did hollow neck bones help long-necked dinosaurs?
3. **EASY** Why do eggshells have tiny pores?

Make it a game • Design Detectives. Walk through the house and find three things that were designed for a job: a door hinge, a cup handle, a zipper. For each one, tell what job it does and who might have planned it. Then name a dinosaur design that does a job too: hollow bones, tooth batteries or breathing eggs.

Scripture. “I will praise thee; for I am fearfully and wonderfully made: marvellous are thy works; and that my soul knoweth right well.” (Psalm 139:14, KJV)

Dinosaurs were “fearfully great,” and so are you. Every good design in God’s creation is a reason to praise Him.

Practice: answers

1. “Terrible lizard” or “fearfully great lizard.”
2. They made the neck lighter while keeping it strong.
3. So air can get in to the baby inside.

TRACK 2 BADGE QUIZZES

The badge quizzes are optional. Read each question aloud; the child may answer by talking, pointing or drawing. Four right out of five earns each badge. Badges and the certificate are earned by doing the stops, not by scores.

Badge quiz 1 (Stops 1–5)

1. On which day did God make the land animals, like the dinosaurs?
2. God said behemoth moved his tail like what?
3. Could Job catch leviathan with a hook? What did Job learn?
4. Name one reason dinosaurs could fit on the Ark.
5. Why must a bone be buried quickly to become a fossil?

Badge quiz 2 (Stops 6–10)

6. Give one idea about where dragon stories came from.
7. Tell one view of what happened to the dinosaurs.
8. On a museum sign, is “68 million years ago” an observation or an interpretation?
9. Name one of the three “ifs” behind a rock-clock date.
10. Name one design God built into dinosaurs.

TRAIL CERTIFICATE: MY DINOSAURS AND THE BIBLE NOTEBOOK AND TRAIL D CERTIFICATE

Gather the Field Notebook pages from this trail into one booklet with a cover: “My Dinosaurs and the Bible Notebook,” your name and the dates you started and finished.

Add your museum sign from Stop D8 and one page with the two views of what happened to the dinosaurs from Stop D7.

Add one Bible verse from the trail that you can say from memory.

When the booklet is done, a parent signs the Trail D certificate.

- **Ten stops:** At least one page for each stop, each with a title and a date.
- **Scripture:** Verses are copied carefully, and the child can say one from memory.
- **Observe or interpret:** The museum sign keeps what we observe apart from what people interpret, and both views are told fairly.
- **Care:** Drawings are labeled and done carefully.

Answer key

1. The sixth day.
2. Like a cedar tree.
3. No. Job learned that God is far greater than anything He made.
4. Any one: only two of each kind were needed; many dinosaurs were small; God may have sent young ones; the Ark was huge, with three decks.

5. Otherwise it is eaten or rots away before it can harden into stone.
6. Any one: people saw living dinosaurs or great reptiles after the Flood; people found big fossil bones; some stories were made up.
7. Either: a giant asteroid hit the earth and the dinosaurs died out; or most died in the Flood and the rest died out afterward in a harder world.
8. An interpretation. No one was there to see it.
9. Any one: we know the starting amount; the rate stayed the same; nothing was added or taken away.
10. Any one: hollow, light neck bones; tooth batteries with new teeth ready; eggshells with tiny pores for air.

SCHOOL LAUNCH · EXPLORE TRACKS

EXPLORE TRACKS · TRAIL E

The fifth trail of three interest tracks for curious Scouts: Animals (insects and small creatures), Dinosaurs (sea and sky reptiles, and the Ice Age) and Great Battles of the World Wars. Short, self-paced stops with true stories, great pictures, hands-on projects and games.

First edition

O LORD, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches.

Psalms 104:24 (KJV)

COURSE GUIDE

Explore Tracks are for children who want more of what they love. Each track is a trail of short stops. At every stop the child hears a true story, studies a great picture, does something with his or her hands, plays a game and adds a page to a Field Notebook.

Trail E is the fifth trail of each track at the  Scout level (ages 7–9). The Animals track gets down on hands and knees with the small creatures, from the ant of Proverbs 6:6 and the locusts of Exodus 10 to Jean-Henri Fabre, the patient insect watcher, and ends with a bug hotel to build. The Dinosaurs track goes to sea and sky with the ichthyosaurs, plesiosaurs, mosasaurs and pterosaurs (reptiles that lived alongside the dinosaurs but were not dinosaurs), then meets the woolly mammoths, saber-toothed cats and giant ground sloths of the Ice Age and the La Brea Tar Pits. The Great Battles track visits eight battles of the two World Wars, from the Marne (1914) to the Battle of the Bulge (1944–1945). Earlier trails are not required first.

WHO IT IS FOR

Written for children about ages 7–9 who are read to by a parent, or who read short passages on their own. Older siblings can join in. Nothing earlier is required.

HOW TO USE THIS COURSE

1. **One stop at a time.** A stop takes 15–25 minutes: read the story aloud, look at the picture, do the hands-on part and play the game. Two or three stops a week works well.
2. **Any order.** The tracks are independent. Do one track at a time, or rotate between them.
3. **Goes deeper in.** Each stop names the School Launch course that teaches the same topic in full (for example Life Science, Earth Science, Gardening & Animals, Geography or History), so a stop can lead straight into a lesson.
4. **Field Notebook.** Every stop ends with a page for the notebook. At the end of the trail the pages become a booklet, and the parent signs the Trail E certificate.
5. **Badge quizzes.** Each track has two short, optional oral quizzes. They are for fun, not grades.

SCOPE AND SEQUENCE

Track 2: Dinosaurs  Trail E: Sea and Sky Reptiles, and the Ice Age (Self-paced)

MATERIALS

- **Field Notebook (a sketchbook or composition book)** One for the whole trail.
- **Colored pencils, a ruler, scissors and glue** For drawings and maps.
- **A magnifying glass and a clear jar with a lid** For looking closely at small creatures. Watch, then let them go where you found them.

- **Household things** Each hands-on project lists what it needs: blocks, clay, string, toy figures, cups, sticks, pinecones and cardboard tubes.
- **A Bible (KJV)** For the verse at each stop.

GRADING

Explore Tracks are not graded. A stop is done when the child has heard the story, done the hands-on part and made a notebook page.

Badges and the Trail E certificate are earned by finishing the stops.

A NOTE TO PARENTS

You do not need to be an expert. Read the story aloud, look at the picture together and ask, “What do you notice?” Each stop has a short *For families* note with background and any facts that scholars still discuss.

Small creatures: the Animals stops invite children to look closely at real insects and spiders. Each one has a safety line: look with eyes and a magnifying glass, do not handle bees, wasps or spiders, wash hands afterward, and let every creature go where it was found.

Dinosaur dates: museums give ages in millions of years for the sea and sky reptiles and in tens of thousands of years for the Ice Age. Stops where dates come up are marked ⌚ and include a short box: *What the sign says*, *What we observe* and *How Christians read it*. The trail teaches the period names as museum words and explains that the dates are interpretations; many Christian families understand the fossils within a young earth and the Flood, with the Ice Age coming after the Flood.

Battles are told for young children: who, where, the plan, what happened and why it mattered, with honor for courage, faith and wisdom and no gory detail. Casualties are given as numbers, and wounds and deaths are stated plainly but not described. Both sides are described fairly, in the terms of their own time. The World War II stops name the crimes of the Nazi regime plainly, in words suited to young children and without images; you may wish to preview those paragraphs.

CONTENTS

Track 2: Dinosaurs 🦖 Trail E: Sea and Sky Reptiles, and the Ice Age

- 2.1 Ichthyosaurs: The Fish Lizards
- 2.2 Plesiosaurs: Long Necks Under the Sea
- 2.3 Mosasaurs: Giant Sea Lizards
- 2.4 Pterosaurs: Wings of Skin
- 2.5 Quetzalcoatlus: Giant of the Sky
- 2.6 Woolly Mammoths: Giants of the Ice Age
- 2.7 Saber-Toothed Cats: Smilodon
- 2.8 Giant Ground Sloths: Megatherium and Megalonyx
- 2.9 The La Brea Tar Pits: Fossils in the City
- 2.10 Build a Museum Display

Each stop takes 15–25 minutes. Tracks may be done in any order, and a child may do just one track.

DINOSAURS TRAIL E: SEA AND SKY REPTILES, AND THE ICE AGE

The fifth trail of the Dinosaurs track visits the creatures that lived alongside the dinosaurs and the giants that came after them. It starts in the sea with ichthyosaurs, plesiosaurs and mosasaurs, rises into the sky with the pterosaurs and the giant Quetzalcoatlus, and then goes to the Ice Age with woolly mammoths, saber-toothed cats, giant ground sloths and the La Brea Tar Pits. It ends with the child building a museum display of their own. None of these animals is a dinosaur, but every museum dinosaur hall has them. Each stop is a short read-aloud story, a picture to study, something to draw or build, quick questions, a game and Scripture.

This is the  **Scout** level, for ages 7 to 9. A parent reads the story aloud, or a strong reader reads it alone, and every stop stands by itself. The track is creation-friendly: God filled the seas and the sky on the fifth day and made the land animals on the sixth (Genesis 1:20–25). Many Christians read the Ice Age as coming in the centuries after Noah’s Flood. Words such as **Jurassic**, **Cretaceous** and **Ice Age** are taught as museum words, and dates on museum signs are called what they are: interpretations. Stops E3, E6, E9 and E10 have the  box: *What the sign says / What we observe / How Christians read it.*

Stops 1 to 5 earn the **Sea and Sky badge**, and Stops 6 to 10 earn the **Ice Age badge** and the **Trail E certificate**. The badge quizzes are at the end of the trail and are optional.

BEFORE YOU BEGIN

- Listen to a story of about five minutes and tell it back.
- Know what a fossil is and the days of creation in Genesis 1 (Trails A and D help but are not required).

MASTERY CHECKLIST

- ☐ I can tell an ichthyosaur, a plesiosaur and a mosasaur apart by their shapes.
- ☐ I can tell how a pterosaur’s wing was made and how it was different from a bird’s or a bat’s.
- ☐ I can name three Ice Age animals and one true fact about each.
- ☐ I can tell how the La Brea Tar Pits trapped animals and kept their bones.
- ☐ I can read a museum sign and tell what we observe from what people think.

OPTIONAL BOOKS AND RESOURCES

- **La Brea Tar Pits and Museum** (<https://tarpits.org>): Free photos, videos and fossil pages about the tar pits, Smilodon, dire wolves and mammoths; for Stops E7 and E9.
- **Oceans of Kansas Paleontology** (<https://oceansofkansas.com>): A free site with photos and history of mosasaurs, plesiosaurs and Pteranodon from the Kansas chalk; for Stops

E2 to E4. A grown-up should pick the pages.

- **Big Bend National Park (National Park Service)** (<https://www.nps.gov/bibe>): Pages on the fossils of Big Bend, including Quetzalcoatlus; for Stop E5.
- **Biodiversity Heritage Library** (<https://www.biodiversitylibrary.org>): Old books and plates by Conybeare, Faujas de Saint-Fond, Cuvier and Figuier to look at and copy in the Field Notebook.

2.1 ICHTHYOSAURS: THE FISH LIZARDS

OBJECTIVES

- Tell how an ichthyosaur was shaped like a dolphin but was really a reptile that breathed air.
- Name two surprising things about ichthyosaurs: their huge eyes and their live-born babies.
- Say Genesis 1:21 and tell what God made on the fifth day.

Warm-up. Make a circle with your two hands, as big as a dinner plate. Some ichthyosaurs had eyes about that big, among the biggest eyes of any animal ever found!

Video slot. Video coming. Ichthyosaurs for children: the “fish lizard,” its big eyes and live birth; Mary Anning’s ichthyosaur at the Natural History Museum, London. Search approved channels (Natural History Museum London, Smithsonian, PBS Eons with preview); preview first.

KEY TERMS

ichthyosaur

A sea reptile shaped like a dolphin (say “IK-thee-oh-sor”). The name means “fish lizard.”

reptile

An animal with a backbone that breathes air and is usually covered with scales, such as a lizard, turtle or crocodile.

flipper

A wide, flat limb used for swimming, like a sea turtle’s or a dolphin’s.

marine reptile

A reptile that lives in the sea. “Marine” means “of the sea.”

CORE IDEAS

The story. Far out in a deep, dim sea, a sleek shape glides through the water. It looks like a dolphin, with a pointed snout, a fin on its back and a tall tail. It swishes its tail and shoots upward. At the top it lifts its nose out of the water and takes a breath of air. Then it dives again, its enormous eyes searching the dark water for a squid.

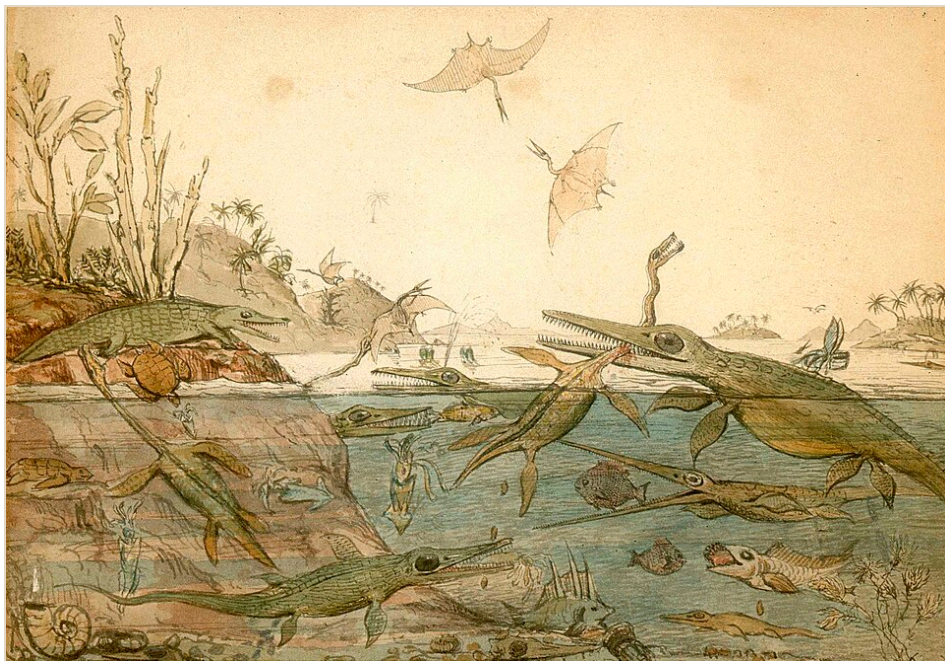
Fish lizard. This animal is an **ichthyosaur** (say “IK-thee-oh-sor”). The name means “fish lizard,” because it was shaped like a fish but had the bones of a **reptile**. It steered with four **flippers** and pushed itself along with its tail, which stood up and down like a shark’s tail. Its long jaws were full of sharp, cone-shaped teeth, just right for grabbing slippery fish and squid.

Eyes like dinner plates. Ichthyosaurs had some of the biggest eyes of any animal ever found. One kind had eyes about 10 inches across, as wide as a dinner plate! A ring of thin bones inside each eye helped it keep its shape. Big eyes gather a lot of light, so ichthyosaurs could probably see well deep down where the water is dark.

Babies born in the sea. An ichthyosaur could not crawl up a beach to lay eggs. Its flippers were made for swimming, not walking. So how did it have babies? Fossils from Germany answer the question: some show a mother with little ones still inside her, and one even seems to show a baby being born. Ichthyosaurs gave birth to live babies right in the water, the way dolphins and whales do.

Made on the fifth day. Genesis tells us that on the fifth day God filled the waters with living creatures, great and small (Genesis 1:21). Ichthyosaur fossils have been found all over the world, from England and Germany to Nevada and China. Museum signs often call the rocks they come from **Jurassic**, a museum word for one set of rock layers. Wherever they are found, they show a Maker who designed a reptile to live its whole life in the sea.

PICTURE STUDY



Duria Antiquior (A More Ancient Dorset), Henry De la Beche, 1830 · Watercolor (later printed as a lithograph) · Amgueddfa Cymru – Museum Wales, Cardiff
Wikimedia Commons · Public domain

Henry De la Beche was a geologist and a friend of Mary Anning. In 1830 he painted this picture of the sea near Lyme Regis as he imagined it long ago. It was one of the first pictures ever made to show fossil animals alive. Prints of it were sold to raise money to help Mary Anning and her family.

Look closely

- Find an ichthyosaur. Look for its long jaws and its big round eye.
- Find a reptile with a very long neck. That is a plesiosaur (Stop E2).
- Look up at the sky. What is flying there?

Talk about it

1. The artist knew these animals only from their bones. What parts of the picture might be guesses?
2. Why do you think he showed the sea from above and below the water at the same time?

HANDS-ON: CLAY ICHTHYOSAUR

Build an ichthyosaur and give it the parts God designed for life in the sea.

You will need

- Modeling clay or play dough (gray, blue or brown)
- Two small buttons or beads for the big eyes
- A toothpick
- A sheet of paper and a crayon

Steps

1. Roll a fat clay sausage for the body. Pinch one end into a long, pointed snout.
2. Shape a tall tail fin that stands up and down, like a shark's. Add a fin on the back.
3. Add four flippers, two big ones in front and two smaller ones behind.
4. Press in two big button eyes. Use the toothpick to poke tiny teeth along the jaws and two nostrils near the eyes.
5. Make a paper label: "Ichthyosaur, the fish lizard. It breathed air."

Check your work

- My ichthyosaur has a long snout, four flippers, a back fin and a tall tail fin.
- It has big eyes and nostrils for breathing air.
- I can tell how an ichthyosaur's babies were born.

FIELD NOTEBOOK

1. Draw an ichthyosaur swimming. Label the snout, eye, flippers, back fin and tail.
2. Draw a dinner plate next to it and write: "Some ichthyosaurs had eyes this big!"

Did you know? Some ichthyosaur fossils still have their last meal inside. Scientists have found tiny hooks from the arms of squid-like animals in the place where the stomach was. Shonisaurus, a giant ichthyosaur found in Nevada, is the state fossil of Nevada.

Goes deeper in. Life Science, the units on animals with backbones and reptiles; and Earth Science, the fossils unit (coming soon). Trail B, Stop B1 tells how Mary Anning and

her brother found the first famous ichthyosaur.

For families. Ichthyosaurs are marine reptiles, not dinosaurs. The very large eyes belong to *Temnodontosaurus*, about 26 cm across (Motani and others, *Nature*, 1999). The birth fossils are from Holzmaden, Germany. *Duria Antiquior* (1830) was lithographed by George Scharf and sold for Mary Anning's benefit; the original watercolor is in the collection of Amgueddfa Cymru – Museum Wales. The picture shows animals eating each other, as a sea does; preview it if your child is sensitive. The stop names "Jurassic" as a museum word and gives no dates.

PRACTICE

1. **EASY** What does "ichthyosaur" mean?
2. **MEDIUM** An ichthyosaur looked like a fish. How do we know it was a reptile that breathed air?
3. **EASY** How were ichthyosaur babies born?

Make it a game • Up for Air. Everyone "swims" around the room as ichthyosaurs. When the leader calls "Dive!" everyone crouches low and holds their breath. When the leader calls "Breathe!" everyone pops up and takes a big breath. Anyone who pops up too early becomes the next leader.

Scripture. "And God created great whales, and every living creature that moveth, which the waters brought forth abundantly, after their kind, and every winged fowl after his kind: and God saw that it was good." (Genesis 1:21, KJV)

God filled the seas on the fifth day. The ichthyosaur, with its big eyes and strong tail, was made for the sea, and God saw that it was good.

Practice: answers

1. "Fish lizard."
2. It had a reptile's bones and nostrils for breathing; it came up to the top of the water for air, as dolphins do.
3. Alive, right in the water.

2.2 PLESIOSAURS: LONG NECKS UNDER THE SEA

OBJECTIVES

- Describe a plesiosaur: a small head, a long neck, a wide body and four flippers.
- Tell how plesiosaurs “flew” through the water with their flippers.
- Tell how a scientist’s mistake about Elasmosaurus was found and fixed.

Warm-up. Stretch your neck up as tall as it will go. Now feel the bones at the back of your neck. You have seven. Some plesiosaurs had about seventy!

Video slot. Video coming. Plesiosaurs for children: long necks, four flippers and how they swam; Mary Anning’s plesiosaur at the Natural History Museum, London. Search approved channels (Natural History Museum London, Smithsonian, PBS Eons with preview); preview first.

KEY TERMS

plesiosaur

A sea reptile with a small head, a long neck and four big flippers (say “PLEE-see-oh-sor”). The name means “near to a lizard.”

vertebra

One of the small bones that make up the backbone and neck. More than one are called vertebrae.

stomach stones

Smooth stones some animals swallow. They may help grind food or help the animal stay steady in the water.

pliosaur

A cousin of the plesiosaurs with a short neck and a very big head (say “PLY-oh-sor”).

CORE IDEAS

The story. One winter day in 1823, Mary Anning was searching the crumbling cliffs at Lyme Regis in England. Slowly she uncovered a skeleton like nothing anyone had seen whole before. It had a tiny head, a neck longer than its body, a wide, flat body like a turtle’s without a shell, and four big flippers. Someone said it looked like a snake pulled through a turtle!

Is it real? In Paris, the great scientist Georges Cuvier saw a drawing of it and was not sure. The neck was so long! Perhaps someone had stuck two fossils together to fool people. So scientists studied the skeleton bone by bone. It was real, and Cuvier said so. The animal was named **Plesiosaurus**, “near to a lizard.”

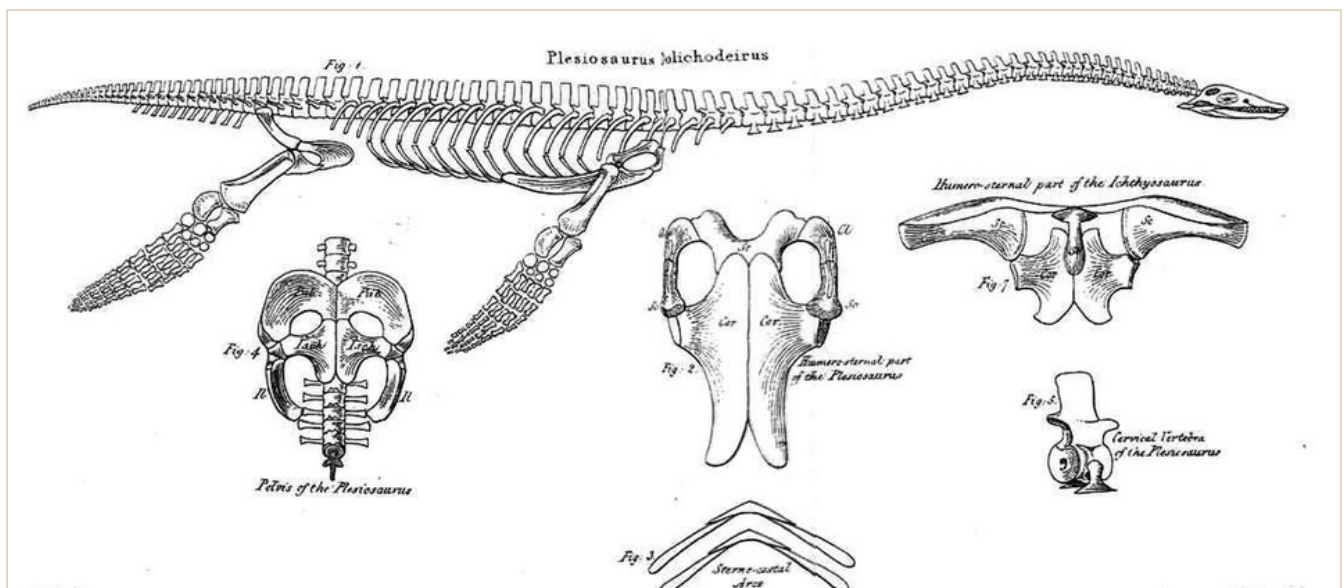
Flying under water. A plesiosaur did not swish a tail to swim. It moved its four flippers up and down, like a sea turtle or a penguin “flying” through the water. Its long neck may have

let it sneak its small head close to a school of fish before the fish noticed the big body behind. Some plesiosaurs swallowed smooth **stomach stones**, which are found with their skeletons.

Head on the wrong end. In America, about 150 years ago, a scientist named Edward Drinker Cope put together the bones of a plesiosaur with an extra-long neck, *Elasmosaurus*. He set the head on the end of the tail! Another scientist, Joseph Leidy, showed that the head belonged on the neck. Cope fixed his drawing. *Elasmosaurus*'s neck had about 70 **vertebrae**. Yours has seven.

Great and small. Not every plesiosaur family had a long neck. Their cousins the **pliosaurs** had short necks and huge heads with strong jaws. The psalm says the sea is full of "both small and great beasts" (Psalm 104:25). Long necks and short necks, small heads and big heads: God's sea creatures are wonderfully different.

PICTURE STUDY



Plesiosaurus dolichodeirus, the skeleton found by Mary Anning, William D. Conybeare, 1824 · Engraving ·
From the Transactions of the Geological Society of London
Wikimedia Commons · Public domain

William Conybeare was an English clergyman and geologist. In 1824 he described the plesiosaur skeleton Mary Anning had found, and this careful drawing of it was printed with his paper. A drawing like this let scientists in other countries study the fossil without traveling to England.

Look closely

- Find the head. How big is it next to the body?
- Look at the neck. Can you count some of the little neck bones?
- Find the flippers. Are the front and back flippers the same size?

Talk about it

1. Why would Cuvier want to see the real skeleton, not only a drawing?
2. What would you say to someone who thought this fossil was a fake?

HANDS-ON: SEVENTY-BONE NECK

Build a plesiosaur with a neck of about seventy “bones” and feel how bendy a long neck can be.

You will need

- A paper plate (the body)
- About 70 pieces of tube pasta or O-shaped cereal
- A long piece of yarn or string
- Paper for a head and four flippers
- Tape and crayons

Steps

1. Color the paper plate as the body. Cut and tape on four flippers.
2. Tie a knot in one end of the yarn. Thread on the pasta, counting out loud by tens, until you have about 70 pieces.
3. Tape a small paper head to the end of the neck. Tape the other end to the body.
4. Wiggle the neck. Now thread only 7 pieces on a short string for your own neck. Which bends more?

Check your work

- My plesiosaur has a small head, a long neck, a wide body and four flippers.
- I counted about 70 neck bones.
- I can tell where Cope put the head by mistake.

FIELD NOTEBOOK

1. Draw a plesiosaur “flying” through the water with its four flippers. Add a school of fish.
2. Draw a pliosaur beside it. Write one way they are different.

Did you know? In 2011, scientists in Los Angeles described a plesiosaur fossil from Kansas with one big baby inside. Like ichthyosaurs, plesiosaurs gave birth to live babies in the sea. Mary Anning’s plesiosaur can still be seen today at the Natural History Museum in London.

Goes deeper in. Life Science, the units on reptiles and on how animals move (coming soon). Trail B, Stop B6 tells more about Cope and the Bone Wars.

For families. Mary Anning found the first nearly complete *Plesiosaurus* in December 1823; Conybeare described it in 1824 (the genus was named by Conybeare and De la Beche in 1821 from partial bones). Cuvier at first doubted the neck and then accepted it. The “snake threaded through a turtle” comparison is often quoted but its first speaker is uncertain, so the stop does not name one. Cope’s reversed *Elasmosaurus* (1868-1869) was pointed out by Joseph Leidy; neck counts of about 70 to 72 vertebrae are commonly given. The pregnant plesiosaur is *Polycotylus* (O’Keefe and Chiappe, *Science*, 2011). The stop gives no dates in millions of years.

PRACTICE

1. **EASY** Name three parts of a plesiosaur.
2. **MEDIUM** How did a plesiosaur swim?
3. **MEDIUM** What mistake did Cope make with *Elasmosaurus*, and who helped fix it?

Make it a game • Long-Neck Tag. The plesiosaur holds both arms straight out in front, hands together, for a long neck. It may tag only with its fingertips, and it must keep its arms straight. The other players are fish. Anyone tagged becomes a second plesiosaur. Play walking, not running.

Scripture. “So is this great and wide sea, wherein are things creeping innumerable, both small and great beasts.” (Psalm 104:25, KJV)

The sea is full of more creatures than we can count, small and great. The long-necked plesiosaur was one of them.

Practice: answers

1. Any three: a small head, a long neck, a wide body, four flippers, a short tail.
2. It moved its four flippers up and down, “flying” through the water like a sea turtle or penguin.
3. He put the head on the tail; Joseph Leidy showed it belonged on the neck.

2.3 MOSASAURS: GIANT SEA LIZARDS

OBJECTIVES

- Tell the story of the great skull found near Maastricht and how it got its name.
- Name two ways a mosasaur was built for catching food in the sea.
- Read a museum sign about mosasaurs and tell the observation from the interpretation.

Warm-up. Open and close your mouth slowly. Your lower jaw bends only at the back, near your ears. A mosasaur had an extra bending joint partway along each side of its lower jaw, so its mouth could spread wide for big bites.

Video slot. Video coming. Mosasaurs for children: the Maastricht skull, the double-hinged jaw and the mosasaurs of the Kansas chalk. Search approved channels (Smithsonian, Natural History Museum London, Sternberg Museum, PBS Eons with preview); preview first.

KEY TERMS

mosasaur

A huge sea lizard with flippers and a long tail (say “MOH-zuh-sor”). The name means “Meuse lizard,” after a river in Europe.

quarry

A place where people dig stone out of the ground.

monitor lizard

A family of big lizards living today, such as the Komodo dragon. Mosasaurs were their cousins.

Cretaceous

A museum word for one set of rock layers (say “krih-TAY-shus”). Mosasaur fossils come from rocks with this label.

CORE IDEAS

The story. Under a hill called Saint Peter’s Mount, near the city of Maastricht in the Netherlands, workers dug long tunnels to cut out soft, chalky stone. Around the year 1780, deep in the **quarry**, their tools struck something hard. Slowly they uncovered a giant head with long jaws and rows of sharp, curved teeth. Word spread fast. What kind of monster was this?

A skull goes to Paris. In 1794 a French army surrounded Maastricht and took the city. The French wanted the famous skull. An old story says soldiers were promised a reward if they found where it was hidden. It was carried to Paris, and it is still in a museum there today.

What was it? Some people thought it was a crocodile, and others a kind of whale. Scientists compared it bone by bone with living animals. They decided it was a giant sea-going lizard, a cousin of the **monitor lizards** like the Komodo dragon. In 1822 it was named **Mosasaurus**, “lizard of the Meuse,” after the river that flows past Maastricht.

Built for the sea. A mosasaur had a long body, four flippers and a strong tail with a fin, which pushed it through the water. Its lower jaw could bend in the middle, and it had extra rows of teeth on the roof of its mouth to keep slippery fish and squid from getting away. The biggest mosasaurs were about as long as a school bus.

Sea monsters in Kansas. Many mosasaur skeletons have been dug out of chalk in western Kansas, more than a thousand miles from the ocean. Chalk is made of tiny shells from the sea, so the sea once covered that land. Psalm 148 calls on the great sea creatures to praise God: “ye dragons, and all deeps.” Even the fiercest sea lizard was made by Him and points to Him.

PICTURE STUDY



The finding of the great Maastricht animal in the quarry, Engraved by G. R. Levillaire for Barthélemy Faujas de Saint-Fond's book on Saint Peter's Mount, 1799 · Engraving · From *Histoire naturelle de la montagne de Saint-Pierre de Maestricht* (Paris)
Wikimedia Commons · Public domain

Faujas de Saint-Fond was a French geologist who wrote a big book about the fossils of Saint Peter's Mount. This picture shows how he imagined the moment the skull was found. Historians think he made the scene more exciting than it really was, but it shows the deep, dark tunnels where the workers dug.

Look closely

- Find the giant jaw in the stone. Can you see the teeth?

- Find the torch and the people. What is each person doing?
- Look at the tunnel walls. What kind of place is this?

Talk about it

1. How would you feel if your shovel hit a giant jaw full of teeth?
2. Why might an artist make a picture more exciting than the real event?

HANDS-ON: BENDY MOSASAUR JAW

Make a paper jaw that bends in the middle, like a mosasaur's, and see how it opens wider.

You will need

- Cardstock or a cereal box
- Four brass paper fasteners (brads)
- Crayons and scissors (with a grown-up)
- A pencil for poking holes (a grown-up helps)

Steps

1. Draw and cut out a long upper jaw with teeth along the bottom edge.
2. Draw the lower jaw in two pieces, a back half and a front half, each with teeth.
3. With a grown-up, poke holes and join the two lower-jaw pieces with a brad so they bend. Join the back of the lower jaw to the upper jaw with another brad.
4. Open and close your jaw. Then bend the middle joint outward. How much wider can the mouth spread?

Check your work

- My jaw opens at the back and bends in the middle.
- I added sharp, curved teeth.
- I can tell why a bendy jaw helped a mosasaur swallow big bites.

FIELD NOTEBOOK

1. Draw a mosasaur swimming. Label the jaws, flippers and tail fin.
2. Find Maastricht and Kansas on a map or globe. Draw a star on each.

Did you know? Some mosasaur fossils are so well kept that scientists can see the outline of the tail. It bent down at the end and had a fin shaped like a half-moon, much like a shark's tail. Mosasaurs have even been found with fish bones inside them.

 **What the sign says / What we observe / How Christians read it.**  **What the sign says:** "Mosasaurs lived in the Cretaceous seas and died out about 66 million years ago." **What we observe:** mosasaur bones lie in thick layers of chalk made of tiny sea shells, together with sharks' teeth, fish and clams, in places like Kansas that are dry land

today. **How Christians read it:** many young-earth Christians read these sea layers on dry land as laid down when the waters of Noah's Flood covered the earth, thousands of years ago. Many other scientists think a shallow sea covered the middle of North America slowly over a very long time. Both agree on what we can see: sea creatures were buried where there is dry land now.

Goes deeper in. Earth Science, the units on rock layers, fossils and the Flood (coming soon); and Geography, for the Netherlands and Kansas.

For families. This stop carries the ⏳ box. The famous second Maastricht skull was found around 1780 and seized by the French in 1794-1795; it is in the Muséum national d'Histoire naturelle, Paris. Faujas de Saint-Fond's account (1798-1799) tells of a reward of wine to the grenadiers who found it; historians think the story was exaggerated, so the stop says only "a reward." *Mosasaurus* was named by William Conybeare in 1822. Lengths for the largest mosasaurs (*Mosasaurus hoffmannii*, *Tylosaurus*) are estimates of roughly 12-15 m or more. The Oceans of Kansas website (Mike Everhart) is a good free source on Kansas mosasaurs.

PRACTICE

1. **EASY** Where was the famous mosasaur skull found?
2. **MEDIUM** Name one way a mosasaur was built to catch slippery food.
3. **MEDIUM** Is "Mosasaur bones are found in chalk in Kansas" an observation or an interpretation?

Make it a game • Mosasaur Gulp. One player is the mosasaur and stands with arms out like big jaws. The others are fish and walk past. When the leader says "Gulp!" the mosasaur closes its arms. Any fish caught inside the jaws becomes a mosasaur too, and the jaws get bigger. Play gently.

Scripture. "Praise the LORD from the earth, ye dragons, and all deeps:" (Psalm 148:7, KJV)

In the King James Bible, "dragons" can mean great creatures of the sea. Even the fiercest sea lizard was made to praise the LORD.

Practice: answers

1. In a quarry under Saint Peter's Mount, near Maastricht in the Netherlands.
2. Any one: a jaw that bent in the middle; extra teeth on the roof of its mouth; sharp, curved teeth.
3. An observation: we can go and see the bones in the chalk.

2.4 PTEROSAURS: WINGS OF SKIN

OBJECTIVES

- Tell how a pterosaur’s wing was made: skin stretched from one very long finger.
- Say how pterosaurs were different from birds, bats and dinosaurs.
- Tell how the first pterosaur fossil puzzled the people who studied it.

Warm-up. Hold up one hand. Count your fingers from the thumb: one, two, three, four. Wiggle finger number four, your ring finger. Now imagine it growing longer than your whole arm. A pterosaur’s wing hung from a finger like that!

Video slot. Video coming. Pterosaurs for children: wings of skin on one long finger; Pterodactylus and Pteranodon; how pterosaurs walked and flew. Search approved channels (Natural History Museum London, Smithsonian, American Museum of Natural History, PBS Eons with preview); preview first.

KEY TERMS

pterosaur

A flying reptile with wings of skin (say “TEHR-oh-sor”; the p is silent). The name means “winged lizard.”

wing membrane

The thin, strong, stretchy skin that made a pterosaur’s wing.

Pterodactylus

The first pterosaur ever named (say “TEHR-oh-DAK-tih-lus”). The name means “wing finger.”

crest

A bony fin or ridge on top of an animal’s head.

CORE IDEAS

The story. In 1784, in a palace in the German city of Mannheim, a museum keeper named Cosimo Collini studied a strange fossil. It had come from the smooth stone quarries of Solnhofen in Bavaria. The skeleton had a long beak full of tiny teeth, a long neck, small legs, and arms with one finger so long it was almost silly. Was it a bird? A bat? Some kind of sea creature? Collini wrote down exactly what he saw, but he could not tell.

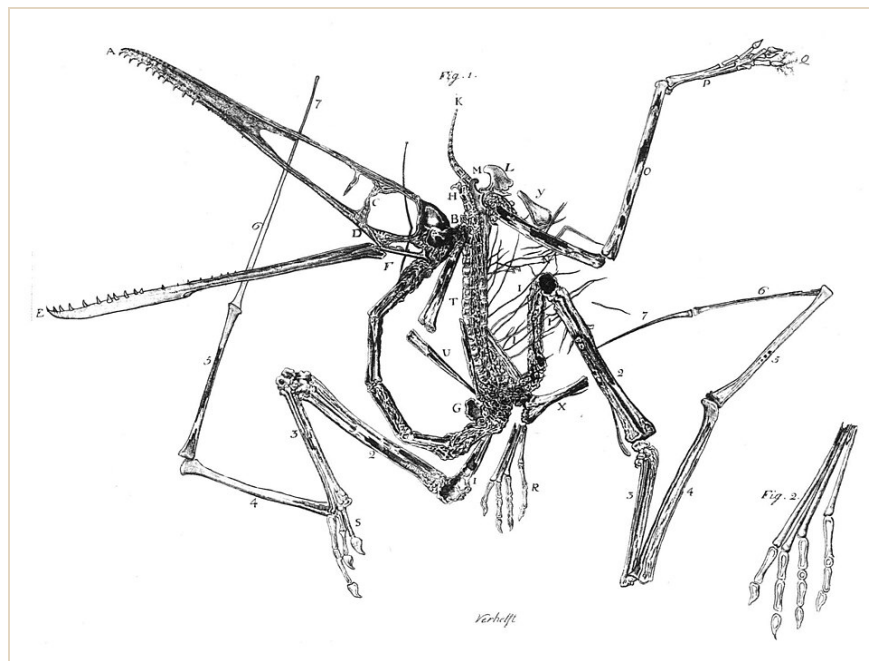
A flying reptile. Years later, the French scientist Georges Cuvier looked at the drawing of the fossil. He said the long finger held up a wing of skin. This was a reptile that flew! In 1809 he named it the “wing finger,” **Pterodactylus**. Since then, hundreds of kinds of **pterosaurs** have been found all over the world.

Not a bird, not a bat, not a dinosaur. A bird's wing is made of feathers. A bat's wing is skin stretched between four long fingers. A pterosaur's wing was skin stretched from just one finger, the fourth, down to its leg. This **wing membrane** was thin but strong. Pterosaurs had light, hollow bones and a fuzzy covering on their bodies. They lived alongside the dinosaurs, but they were not dinosaurs.

Big and small. Some pterosaurs were as small as a sparrow. Pteranodon, found in Kansas, had wings about 20 feet across, a beak with no teeth and a tall **crest** on the back of its head. Rhamphorhynchus had a long tail with a little flap at the tip, like a kite's tail. On the ground, pterosaurs folded up their wings and walked on all four limbs. Their footprints have been found in stone.

The open firmament. On the fifth day God said, "Let the waters bring forth abundantly the moving creature that hath life, and fowl that may fly above the earth" (Genesis 1:20). Museum signs often label pterosaur rocks **Jurassic** or **Cretaceous**, museum words for sets of rock layers. However high they flew, they flew in the sky God made.

PICTURE STUDY



The Mannheim fossil (the first Pterodactylus), Engraving made for Cosimo Alessandro Collini, 1784 · Copper engraving · From the Acta of the Palatine Academy, Mannheim; the fossil itself is in the Bavarian State Collection in Munich
Wikimedia Commons · Public domain

This is the very first picture ever printed of a pterosaur fossil. Collini did not know what the animal was, so he had it drawn just as it lay in the stone. Careful drawings like this let Cuvier, far away in Paris, work out that it was a flying reptile.

Look closely

- Find the skull and the long beak.

- Find the very long finger bones. Follow them back to the arm.
- Find the legs. Are they big or small next to the arms?

Talk about it

1. Why was it wise for Collini to draw exactly what he saw, even when he did not understand it?
2. If you were Cuvier, what clue would tell you this animal could fly?

HANDS-ON: THREE WINGS

Trace your own arm and hand to see how a bird, a bat and a pterosaur each make a wing.

You will need

- Three large sheets of paper (or one long roll)
- A pencil and crayons
- A grown-up to help trace

Steps

1. Lay your arm and hand on the first sheet, fingers spread, and have a grown-up trace around them. Do the same on the other two sheets.
2. Sheet one, the bird: draw long feathers growing from the arm and hand.
3. Sheet two, the bat: make all four fingers very long and color skin stretched between them.
4. Sheet three, the pterosaur: make only the fourth finger very long, then color skin stretched from its tip down to the hip. Label each sheet.

Check your work

- I made a bird wing, a bat wing and a pterosaur wing.
- My pterosaur wing hangs from one long finger.
- I can tell how a pterosaur is different from a bird and a bat.

FIELD NOTEBOOK

1. Draw a pterosaur flying. Label the long fourth finger, the wing membrane and the crest (if it has one).
2. Draw a pterosaur walking on all fours with its wings folded.

Did you know? The word “pterodactyl” is often used for all pterosaurs, but it really belongs to one kind, Pterodactylus. Scientists say “pterosaur” for the whole group. Some pterosaurs had bright crests that may have helped them recognize one another.

Goes deeper in. Life Science, the units on how animals fly and on reptiles (coming soon); and Art, for drawing from a careful observation.

For families. Collini described the Mannheim specimen in 1784 in the *Acta Academiae Theodoro-Palatinae* without deciding what it was; Cuvier identified it as a flying reptile (1801) and named it in 1809. The specimen is the holotype of *Pterodactylus antiquus*, now in the Bavarian State Collection of Palaeontology and Geology, Munich. Pteranodon wingspans are usually estimated at about 6 to 7 m in the largest individuals. Pterosaurs are close relatives of dinosaurs but not dinosaurs. The stop names “Jurassic” and “Cretaceous” as museum words and gives no dates.

PRACTICE

1. **EASY** What was a pterosaur’s wing made of?
2. **MEDIUM** How is a bat’s wing different from a pterosaur’s?
3. **EASY** Was a pterosaur a dinosaur?

Make it a game • Bird, Bat or Pterosaur?. The leader calls out a wing. For “Bird!” everyone flaps arms with fingers together like feathers. For “Bat!” everyone spreads all their fingers wide. For “Pterosaur!” everyone tucks in their fingers and points only the ring finger out long. Anyone who makes the wrong wing becomes the next leader.

Scripture. “And God said, Let the waters bring forth abundantly the moving creature that hath life, and fowl that may fly above the earth in the open firmament of heaven.” (Genesis 1:20, KJV)

God filled the sky with flying creatures. Birds, bats and pterosaurs each fly in a different way, and God designed every one.

Practice: answers

1. Skin stretched from one very long finger (the fourth) down to its leg.
2. A bat’s wing is skin between four long fingers; a pterosaur’s hangs from one long finger.
3. No. It was a flying reptile that lived alongside the dinosaurs.

2.5 QUETZALCOATLUS: GIANT OF THE SKY

OBJECTIVES

- Tell where and how Quetzalcoatlus was found.
- Compare the size of Quetzalcoatlus with things we know: a giraffe and a small airplane.
- Tell how scientists think such a big animal got off the ground.

Warm-up. Stand in a row with your family, arms stretched out, fingertip to fingertip. It would take about six grown-ups in a row to reach across the wings of Quetzalcoatlus!

Video slot. Video coming. Quetzalcoatlus, the giant pterosaur from Big Bend, Texas: its size and how it took off. Search approved channels (University of Texas Jackson School of Geosciences, National Park Service, Smithsonian, PBS Eons with preview); preview first.

KEY TERMS

Quetzalcoatlus

One of the largest flying animals ever found, a giant pterosaur from Texas (say “KET-sul-koh-AT-lus”).

wingspan

The distance from the tip of one wing to the tip of the other.

launch

To push off into the air to start flying.

Big Bend National Park

A desert park in Texas along the Rio Grande river, where Quetzalcoatlus was found.

CORE IDEAS

The story. In 1971, a young college student named Douglas Lawson was hiking through the hot, dry hills of Big Bend National Park in Texas, near the Rio Grande river. He was looking for fossils for his studies. Sticking out of the rock he found a bone, a hollow wing bone so big that at first it was hard to believe it came from something that flew.

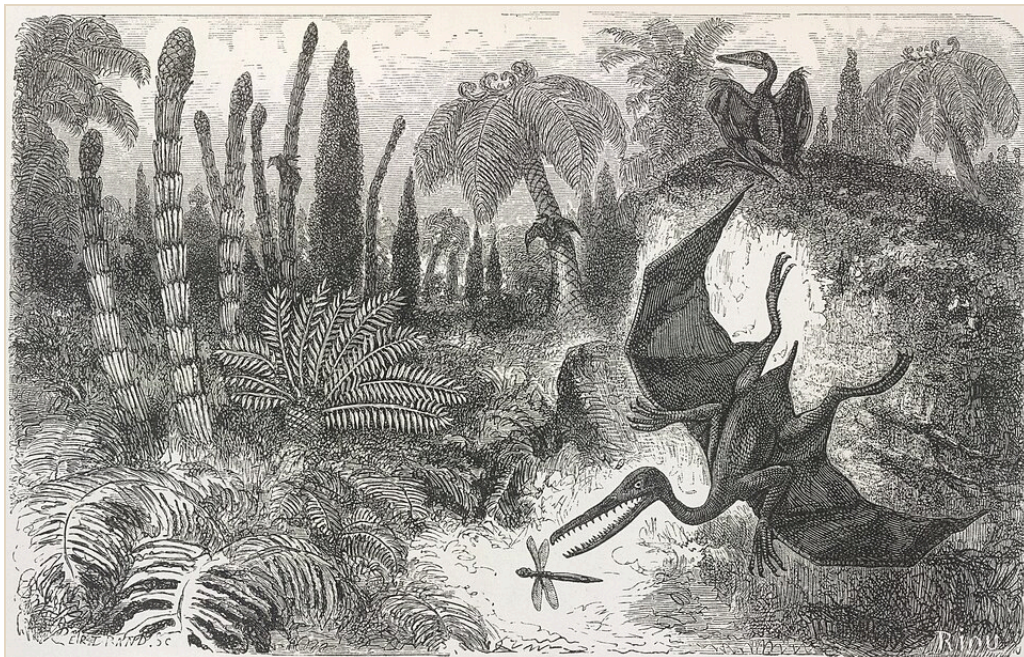
A name from Mexico. Lawson and other searchers found more bones. In 1975 he named the animal **Quetzalcoatlus**, after Quetzalcoatl, the “feathered serpent” of the old stories of the Aztec people of Mexico. The name fits a flying giant found just across the river from Mexico.

How big? Quetzalcoatlus was a pterosaur, a flying reptile. Its **wingspan** was about 33 to 36 feet, about as wide as the wings of a small airplane. When it stood on the ground with its wings folded, its head may have been as high as a giraffe’s. Yet its bones were hollow, with thin walls, so it was very light for its size. It had a long, stiff neck and a long beak with no teeth.

Walking hunter. What did a giant like this eat? Scientists once thought it might skim fish from the water. Many now think it walked on all fours across open land and riverbanks, the way a stork does, and snapped up small animals with its long beak.

Up, up and away. How did something so big get into the air? Scientists who studied its bones think it crouched down and leaped with its strong arms and legs, jumping about 8 feet high. Then it swept its great wings down and was flying. God asks Job, “Doth the hawk fly by thy wisdom?” (Job 39:26). No person taught Quetzalcoatlus to fly. Its Maker gave it everything it needed.

PICTURE STUDY



Ideal Landscape of the Liassic Period, with pterosaurs, Édouard Riou, 1865 (English edition) · Wood engraving · From Louis Figuier, *The World Before the Deluge* (London); this copy is in the British Library
Wikimedia Commons · CC0

Édouard Riou drew pictures for a famous French book about fossils, and later he drew for Jules Verne’s adventure stories. In the 1860s people knew only small pterosaurs, so Riou drew them small, with wings like a bat’s. Nobody yet guessed that a pterosaur as big as Quetzalcoatlus would one day be found in Texas.

Look closely

- Find the flying reptiles. How many can you count? What is one of them chasing?
- Look at the shape of their wings. Do they look like the wings you drew in Stop E4?
- Find the plants. Are any like plants you know?

Talk about it

1. How would Riou have to change his picture to show Quetzalcoatlus?
2. Why do pictures of fossil animals change when new fossils are found?

HANDS-ON: LIFE-SIZE WINGS IN CHALK

Draw the wings of Quetzalcoatlus full size on a driveway, sidewalk or playground, and stand inside them.

You will need

- Sidewalk chalk
- A tape measure, or a string 3 feet long (one yard)
- A driveway, sidewalk or paved playground (a grown-up chooses a safe place away from cars)

Steps

1. With a grown-up, measure a straight line 35 feet long. With a one-yard string, that is about 12 string-lengths. Mark both ends.
2. Mark the middle. Draw a small body and a long neck and beak there.
3. Draw a long, narrow wing from the body out to each end of the line.
4. Lie down in the wings with your family, fingertip to fingertip. How many of you fit across? Then measure how tall a giraffe is (about 16 to 18 feet) and draw a line for that too.

Check your work

- My chalk wings are about 35 feet from tip to tip.
- I counted how many people fit across the wings.
- I can tell how scientists think Quetzalcoatlus took off.

FIELD NOTEBOOK

1. Draw Quetzalcoatlus standing next to a giraffe and a person. Label each.
2. Draw a map of Texas and mark Big Bend National Park near the Rio Grande.

Did you know? For many years Quetzalcoatlus was known mostly from a few bones, so scientists had to make careful guesses. In 2021 a team published a big set of studies on all the Big Bend fossils, the most complete look at this giant so far. The bones are kept at the University of Texas at Austin.

Goes deeper in. Life Science, the units on flight (coming soon); Geography, for Texas, the Rio Grande and Mexico; and Arithmetic, for measuring in feet and yards.

For families. Douglas Lawson found the first bones in 1971 and named *Quetzalcoatlus northropi* in 1975 (in *Science*); the 2021 Society of Vertebrate Paleontology Memoir (Andres, Langston and others) described the material and proposed the leaping launch (about 2.4 m). Wingspan estimates vary; about 10 to 11 m is common, and some sources give a little more. The “stork-like ground hunter” idea is from Witton and Naish (2008) and is widely but not universally accepted, so the stop says “many now think.” The animal

is named after Quetzalcoatl, a deity of Aztec religion; the stop calls it a figure of old Aztec stories. Riou's plate titles vary between editions of Figuier's book. The stop gives no dates.

PRACTICE

1. **EASY** Where was Quetzalcoatlus found?
2. **MEDIUM** How was such a big animal light enough to fly?
3. **MEDIUM** How do scientists think Quetzalcoatlus took off?

Make it a game • Leap and Soar. Everyone crouches on hands and feet like a resting pterosaur. When the leader calls "Launch!" everyone springs up as high as they can and spreads their arms wide to "soar" slowly across the room. When the leader calls "Land!" everyone folds their wings and walks on all fours. Play on a soft surface.

Scripture. "Doth the hawk fly by thy wisdom, and stretch her wings toward the south? Doth the eagle mount up at thy command, and make her nest on high?" (Job 39:26-27, KJV)

God asked Job these questions to show that the wisdom of flight comes from Him. The giant Quetzalcoatlus flew by God's wisdom, not by man's.

Practice: answers

1. In Big Bend National Park in Texas, near the Rio Grande.
2. Its bones were hollow, with thin walls.
3. It crouched and leaped about 8 feet high with its strong arms and legs, then flapped its wings.

2.6 WOOLLY MAMMOTHS: GIANTS OF THE ICE AGE

OBJECTIVES

- Name three ways a woolly mammoth was made for the cold.
- Tell the story of Lyuba, the baby mammoth found frozen in Siberia.
- Tell how many Christians read the Ice Age as coming after Noah's Flood.

Warm-up. Feel your ears. Now look at a picture of an African elephant's huge, flapping ears. A woolly mammoth's ears were small and furry. Small ears lose less heat, so they helped keep the mammoth warm.

Video slot. Video coming. Woolly mammoths for children: Lyuba the baby mammoth, mammoth fur and tusks, and cave drawings of mammoths. Search approved channels (Field Museum, Smithsonian, Natural History Museum London, National Geographic Kids); preview first.

KEY TERMS

woolly mammoth

A big, hairy member of the elephant family that lived in cold lands in the north.

tusk

A very long tooth that grows out of the mouth, like an elephant's.

permafrost

Ground that stays frozen all year long, even in summer.

Ice Age

A time when great sheets of ice covered much of the northern lands. Many Christians believe there was one Ice Age, in the years after Noah's Flood.

CORE IDEAS

The story. In the spring of 2007, a reindeer herder named Yuri Khudi was walking with his sons along a riverbank in Siberia, in the far north of Russia. There, lying on the frozen ground, was a baby mammoth, whole, with its skin, its little trunk and its eyes. It looked almost as if it were asleep. Scientists named the baby **Lyuba**, which means "love," after Mr. Khudi's wife. She was only about a month old when she died, and she had been kept frozen in the **permafrost** ever since.

Dressed for the cold. A **woolly mammoth** was about as tall as an elephant today. It wore two coats of hair: thick, soft wool next to the skin and long, shaggy hair on top. It had small ears, a short tail and a layer of fat under its skin. A hump of fat on its back stored food for the long winter. God gave the mammoth everything it needed for a cold, snowy land.

Tusks and teeth. Mammoths had long **tusks** that curved up and around in a great spiral. Some were more than 10 feet long. They may have used them to sweep snow off the grass and to defend themselves. Their back teeth were wide and ridged like a washboard, just right for grinding tough grass all day long.

People saw them. People hunted mammoths and drew them. On the walls of caves in France, people long ago painted and scratched pictures of mammoths with humped backs and long tusks. In some places people built huts using mammoth bones. Mammoths and people lived on the earth at the same time.

One Ice Age. Where did all that ice come from? Many Christian scientists think the Ice Age came after Noah's Flood. Warm oceans sent up lots of water into the air, and dust from volcanoes kept the summers cool, so snow piled up for hundreds of years and turned to ice. Mammoths roamed the cold grasslands at the edge of the ice. God asks Job, "Out of whose womb came the ice?" (Job 38:29). The answer is: from God.

PICTURE STUDY



Woolly Mammoths and Woolly Rhinoceroses, Charles R. Knight, c. 1929 · Oil on canvas (mural) · Field Museum of Natural History, Chicago
Wikimedia Commons · Public domain

Charles R. Knight was one of the first artists to paint fossil animals as if they were alive. He studied real elephants at the zoo and the bones of mammoths in the museum before he painted. This great mural shows a herd of woolly mammoths walking through the snow in a cold land.

Look closely

- Find the humps on the mammoths' backs. Can you find the baby?
- Look at the tusks. Which way do they curve?
- Find the other animals in the picture. What are they?

Talk about it

1. How did Knight show that this was a cold place?

2. Why would watching real elephants help an artist paint mammoths?

HANDS-ON: THE WOOLLY MITTEN TEST

Find out how fur and fat kept a mammoth warm.

You will need

- Three zip-top sandwich bags
- Cotton balls or yarn (the woolly coat)
- Vegetable shortening (the fat)
- A big bowl of ice water
- A towel

Steps

1. Fill one bag with cotton balls or yarn. Fill another with a thick layer of shortening (a grown-up helps spread it). Leave the third bag empty.
2. Put your hand inside a second, clean bag first so it stays dry, then slip it into the empty bag. Dip it in the ice water. Count how long until it feels too cold.
3. Try again with the woolly bag, and then the fat bag. Count each time.
4. Which bag kept your hand warm longest? Dry off with the towel and talk about how the mammoth had both wool and fat.

Check your work

- I tested all three bags.
- I can tell which kept my hand warmest.
- I can name three ways a mammoth was made for the cold.

FIELD NOTEBOOK

1. Draw a woolly mammoth in the snow. Label the hump, small ears, short tail, long hair and tusks.
2. Draw baby Lyuba and write one sentence about how she was found.

Did you know? Columbian mammoths, the cousins of the woolly mammoth, lived farther south in North America and were even bigger. They had less hair, and their bones have been found from Canada to Mexico. Many “mammoth” fossils in the United States belong to them.

 **What the sign says / What we observe / How Christians read it.**  **What the sign says:** “Woolly mammoths lived during the Ice Age, which began about 2.6 million years ago. The last mammoths died out about 4,000 years ago.” **What we observe:** mammoths frozen in the ground in Siberia and Alaska with hair, skin and even food in their stomachs; mammoth bones and tusks; and pictures of mammoths drawn by people on cave walls. **How Christians read it:** many young-earth Christians teach one Ice Age,

starting soon after Noah's Flood and lasting several hundred years, about 4,000 years ago; they say the Flood's warm oceans and volcanic dust made it happen. Other Christians accept the longer dates. Both can agree on what we see: mammoths lived in cold lands, and people knew them.

Goes deeper in. Earth Science, the units on glaciers and the Ice Age (coming soon); Geography, for Siberia; and History, for the cave paintings of early people.

For families. This stop carries the ⏳ box. Lyuba was found in May 2007 on the Yamal Peninsula by Yuri Khudi; she was named for his wife and is about one month old (Field Museum and others). Mud in her trunk and mouth suggests she sank in mud; the stop says only that she died. The post-Flood Ice Age model is taught by creation geologists such as Michael Oard; mainstream science dates many glacial cycles, the last ending about 11,700 years ago, with mammoths surviving on Wrangel Island until about 4,000 years ago. Cave images of mammoths are found at Rouffignac and Chauvet in France; mammoth-bone dwellings at sites such as Mezhyrich in Ukraine.

PRACTICE

1. **EASY** Name two ways a woolly mammoth was made for the cold.
2. **EASY** Who was Lyuba?
3. **MEDIUM** How do we know people and mammoths lived at the same time?

Make it a game • Mammoth March. Everyone is a mammoth in a herd, walking in a line through the "snow." The leader calls out a job: "Sweep the snow!" (swing your arms like tusks), "Grind the grass!" (chew), "Storm!" (huddle close together to stay warm). The last one to do it becomes the leader.

Scripture. "Out of whose womb came the ice? and the hoary frost of heaven, who hath gendered it? The waters are hid as with a stone, and the face of the deep is frozen." (Job 38:29-30, KJV)

God asked Job who made the ice and frost. The answer is God Himself. He rules over the snow and ice, and He made the mammoth to live in it.

Practice: answers

1. Any two: two coats of hair, small ears, a short tail, a layer of fat, a fat hump on its back.
2. A baby woolly mammoth found frozen in Siberia in 2007.
3. People painted and carved mammoths on cave walls, and built huts with mammoth bones.

2.7 SABER-TOOTHED CATS: SMILODON

OBJECTIVES

- Describe Smilodon: its long teeth, strong front legs and short tail.
- Tell why “saber-toothed tiger” is not quite the right name.
- Tell how Smilodon used its strong arms and wide-opening jaws.

Warm-up. Open your mouth as wide as you can. A grown-up can measure the gap with a ruler. A Smilodon could open its mouth so wide that its jaws made a corner wider than the corner of a square!

Video slot. Video coming. Smilodon, the saber-toothed cat, for children: its teeth, its jaws and the Smilodon fossils of La Brea. Search approved channels (La Brea Tar Pits and Museum, Natural History Museum of Los Angeles County, Smithsonian, PBS Eons with preview); preview first.

KEY TERMS

Smilodon

The best-known saber-toothed cat (say “SMY-loh-don”). The name means “knife tooth.”

canine tooth

One of the long, pointed teeth near the front of the mouth. You have four.

predator

An animal that hunts other animals for food.

state fossil

A fossil chosen by a state as its special symbol. Smilodon is the state fossil of California.

CORE IDEAS

The story. Evening is coming over a grassy plain. Near a pond, a big cat crouches low in the tall grass. It is heavy and strong, with a short, stubby tail like a bobcat’s. When it opens its mouth to yawn, two long, flat fangs flash in the last of the sunlight. This is **Smilodon**, the saber-toothed cat.

Not a tiger. People often call it a “saber-toothed tiger,” but it was not a tiger at all. It was a cat of its own kind. It was about as big as a lion, but stockier, with thick, powerful front legs and big paws. A saber is a long, curved sword, and that is what its teeth looked like.

Knife teeth. Smilodon’s two upper **canine teeth** showed about 7 inches below its lip, about as long as a grown-up’s hand. They were flat like knife blades, and the edges had tiny bumps like a steak knife. But flat teeth can snap if they hit hard bone. So scientists think Smilodon first held big animals still with its strong arms, and only then used its teeth. Its jaws could open very, very wide to make room for them.

Fossils in California. More Smilodon fossils have come from the La Brea Tar Pits in Los Angeles than from anywhere else in the world: bones of more than two thousand cats (Stop E9). Some of the bones show old injuries that had healed. In 1974 Smilodon was made the **state fossil** of California.

Meat from God. “The young lions roar after their prey, and seek their meat from God” (Psalm 104:21). Even a fierce **predator** depends on God for its food. Many Christians believe animals did not hunt each other before Adam’s sin, and the Bible promises a day when “the lion shall eat straw like the ox” (Isaiah 11:7).

PICTURE STUDY



Smilodon (Saber-Toothed Cat), Charles R. Knight, 1903 · Oil on canvas · American Museum of Natural History, New York
Wikimedia Commons · Public domain

Charles R. Knight loved big cats. He spent many hours at the zoo drawing lions and tigers so he could make his Smilodon look real. In this painting a saber-toothed cat snarls on the edge of a rocky cliff.

Look closely

- Find the two long fangs. How wide is the mouth open?
- Look at the front legs and paws. Are they thin or thick?
- Look for the tail. Is it long or short?

Talk about it

1. How did Knight make this cat look strong?
2. Knight used living lions to help him paint. What living animal would you study to draw a Smilodon?

HANDS-ON: HOW LONG IS A SABER?

Make a paper saber tooth and compare it with your own teeth and a pet cat's.

You will need

- White cardstock or paper
- A ruler
- A pencil, crayons and scissors (with a grown-up)
- A mirror

Steps

1. With the ruler, draw a long, flat, curved tooth 7 inches long. This is the part that showed below the lip.
2. Add 4 more inches at the top for the root hidden in the jaw, in a different color. The whole tooth is about 11 inches!
3. Cut it out and add tiny bumps along the back edge, like a steak knife.
4. Look at your own canine teeth in the mirror. Hold your paper saber next to your face. If you have a cat, look (gently!) at its fangs too.

Check your work

- My saber tooth is 7 inches long, plus a root.
- I compared it with my own canine teeth.
- I can tell why Smilodon held its food still before biting.

FIELD NOTEBOOK

1. Draw Smilodon. Label the saber teeth, the strong front legs and the short tail.
2. Draw your paper saber next to a drawing of your own tooth, and write how long each is.

Did you know? The biggest saber-toothed cat lived in South America and may have been heavier than any lion living today. Smilodon was not the only animal with saber teeth. Several other kinds of animals, even some that were not cats, had long fangs too.

Goes deeper in. Life Science, the units on mammals and on predators and prey (coming soon); and Art, for drawing animals from life.

For families. Figures are commonly cited by the La Brea Tar Pits and Museum: upper canines up to about 7 in (18 cm) exposed and about 11 in (28 cm) with the root; remains of more than 2,000 Smilodon individuals from La Brea. Gape estimates are about 110 to 120 degrees. Smilodon was designated California's state fossil in 1974. The largest species, *Smilodon populator*, lived in South America. The hunting description is kept gentle; the stop does not describe kills. The note on Genesis 1:29-30 and the Fall reflects

a common young-earth reading. Knight's 1903 painting is in the AMNH collection; this stop gives no dates.

PRACTICE

1. **EASY** Was Smilodon a tiger?
2. **MEDIUM** Why did Smilodon need to hold its food still before biting?
3. **EASY** Which state has Smilodon as its state fossil?

Make it a game • Saber Statues. Everyone prowls slowly around the room like a big cat. When the leader calls “Saber!” everyone freezes with their mouth open as wide as they can and two fingers pointing down from the top lip like fangs. The leader picks the best saber statue to lead the next round.

Scripture. “The young lions roar after their prey, and seek their meat from God.” (Psalm 104:21, KJV)

Even the strongest cat cannot feed itself without God. He cares for every creature He made.

Practice: answers

1. No. It was a saber-toothed cat of its own kind.
2. Its long, flat teeth could snap if they hit hard bone.
3. California.

2.8 GIANT GROUND SLOTHS: MEGATHERIUM AND MEGALONYX

OBJECTIVES

- Describe a giant ground sloth and compare it with a tree sloth today.
- Tell the story of the Megatherium skeleton set up in Madrid.
- Tell what Thomas Jefferson thought the giant claw belonged to, and what it really was.

Warm-up. Pretend to hang upside down from a branch like a tree sloth, slowly, slowly. Now imagine a sloth as big as an elephant. Could any tree hold it? Giant ground sloths stayed on the ground!

Video slot. Video coming. Giant ground sloths for children: Megatherium, Megalonyx and sloth fossils in caves. Search approved channels (Smithsonian, Natural History Museum of Los Angeles County, La Brea Tar Pits and Museum, National Park Service, PBS Eons with preview); preview first.

KEY TERMS

ground sloth

A big cousin of today's tree sloths that lived on the ground. Some were as big as elephants.

Megatherium

One of the biggest ground sloths (say "meg-uh-THEER-ee-um"). The name means "great beast."

Megalonyx

A ground sloth named from claw bones studied by Thomas Jefferson (say "meg-AL-oh-nix"). The name means "great claw."

skeleton mount

A set of fossil bones put together and held up on a frame so it stands as the animal did.

CORE IDEAS

The story. In 1787, beside the Luján River in Argentina, a priest came upon some enormous bones in the riverbank. They were packed into seven big wooden crates and sent across the ocean by ship to the king of Spain. In Madrid, a museum worker named Juan Bautista Bru unpacked them and began to fit them together, bone by bone. When he was done, a giant skeleton stood on its own. It was the first big fossil animal ever set up to stand as it had in life.

The great beast. No one had seen anything like it. The French scientist Georges Cuvier studied Bru's drawings and saw that the bones were like the bones of a sloth, only far, far

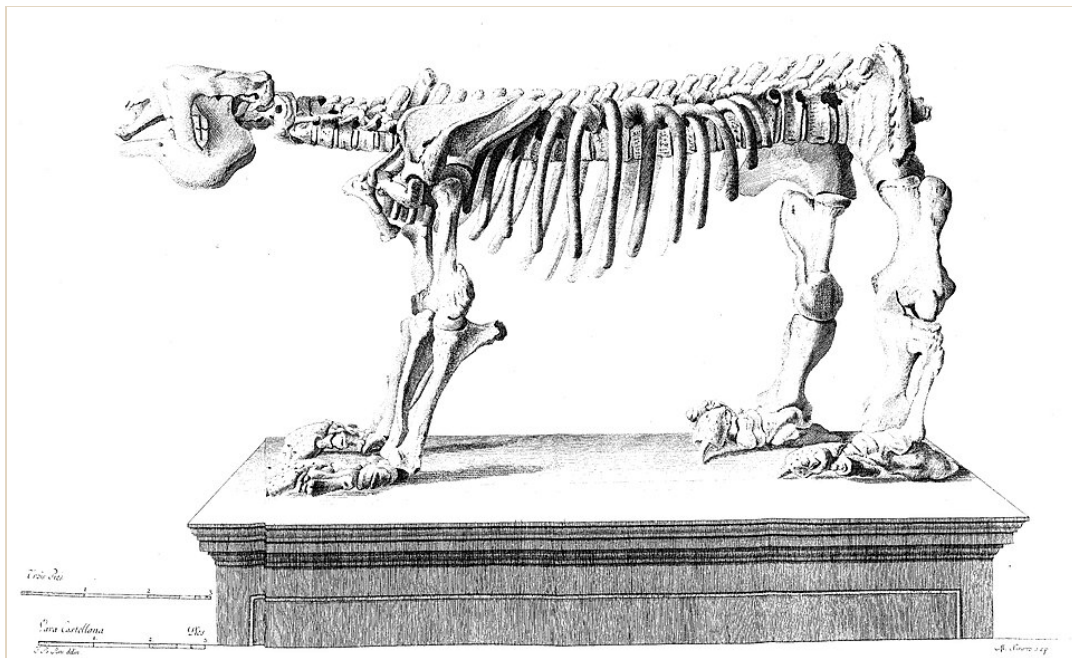
bigger. In 1796 he named it **Megatherium**, “great beast.” It was as big as an elephant. It could rear up on its back legs, leaning on its thick tail like a stool, and pull down tree branches with its long, curved claws to eat the leaves.

Jefferson’s claw. In America, Thomas Jefferson was sent some big claw bones from a cave in what is now West Virginia. At first he thought they came from a giant lion! In 1797 he told other scientists about them and called the animal **Megalonyx**, “great claw.” Later it was shown to be a ground sloth too, and it was named *Megalonyx jeffersonii* in his honor.

Walking on the sides of its feet. Ground sloths had claws so long and curved that they could not put their feet down flat. They walked on the sides of their feet and the backs of their knuckles. Some had tiny pebbles of bone in their skin, like armor under the fur. In dry caves near the Grand Canyon, explorers even found the dried droppings and hair of ground sloths. The droppings showed which desert plants they had eaten.

Many works. Today’s sloths are small and live in the trees of Central and South America. Their giant cousins walked the ground of both Americas. “O LORD, how manifold are thy works!” (Psalm 104:24). Manifold means many and different. Big sloths and little sloths, ground sloths and tree sloths: God made them all in wisdom.

PICTURE STUDY



The skeleton of the Megatherium in the Royal Cabinet, Madrid, Juan Bautista Bru (drawing), engraved by Manuel Navarro, 1796 · Engraving after a drawing · From José Garriga’s description of the skeleton (Madrid, 1796); the skeleton is in the National Museum of Natural Sciences, Madrid
Wikimedia Commons · Public domain

Juan Bautista Bru put the Megatherium skeleton together and drew it carefully. These pictures were printed and sent to scientists in other countries. Cuvier named the animal

from them, and even Thomas Jefferson saw them. The skeleton still stands in a museum in Madrid.

Look closely

- Find the skull. Is it big or small next to the body?
- Find the claws on the feet.
- Look at the legs. Are they thin like a deer's or thick like an elephant's?

Talk about it

1. Why did scientists far away need a careful drawing?
2. Today scientists think Bru set up some bones a little wrong. Why is it all right to fix a mistake later?

HANDS-ON: SLOTH CLAWS

Wear cardboard claws and find out why ground sloths could not walk flat on their feet.

You will need

- Thin cardboard (a cereal box)
- An old pair of gloves or two socks
- Tape
- Scissors and a pencil (with a grown-up)
- A towel hung over a door or chair (the "branch")

Steps

1. Draw and cut out six long, curved claws, about as long as your hand.
2. Tape three claws to the fingers of each glove or sock. Put them on.
3. Try to walk on all fours with your palms flat. Now try curling your hands and walking on the sides and knuckles. Which works with long claws?
4. Stand up tall and use your claws to hook and pull down the towel "branch." Then try to pick up a coin. What are sloth claws good for, and what are they bad for?

Check your work

- I made claws and wore them.
- I tried walking flat and walking on my knuckles.
- I can tell why ground sloths walked on the sides of their feet.

FIELD NOTEBOOK

1. Draw Megatherium standing up on its back legs and tail, reaching for a branch.
2. Draw a tree sloth hanging from a branch beside it. Write: "Manifold are thy works."

Did you know? Bones of Megalonyx have been found as far north as Alaska and the Yukon. A smaller ground sloth, Harlan's ground sloth, is one of the animals found at the La Brea Tar Pits (Stop E9). Megalonyx jeffersonii is the state fossil of West Virginia.

Goes deeper in. Life Science, the units on mammals (coming soon); History, for Thomas Jefferson; and Geography, for Argentina and Spain.

For families. The Luján skeleton was found in 1787 and reached Madrid in 1788; Bru mounted it and, with Joseph Garriga, published a description in 1796 with engravings by Manuel Navarro. Cuvier named *Megatherium americanum* in 1796 from Bru's drawings. Jefferson presented his paper on *Megalonyx* to the American Philosophical Society in 1797; the bones came from a cave in Greenbrier County, now West Virginia; Desmarest named *M. jeffersonii* in 1822. The dung finds are from Rampart Cave in the Grand Canyon (Shasta ground sloth). The stop gives no dates.

PRACTICE

1. **EASY** What does Megatherium mean, and how big was it?
2. **MEDIUM** What did Thomas Jefferson first think his giant claw came from?
3. **MEDIUM** Why did ground sloths walk on the sides of their feet?

Make it a game • Slow Sloth Race. Everyone lines up and “races” across the room, but the slowest one wins! Players must keep moving all the time; anyone who stops still is out. The last sloth to reach the other side is the winner.

Scripture. “O LORD, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches.” (Psalm 104:24, KJV)

“Manifold” means many and different. God made giant sloths and little ones, and the earth is full of the riches of His creation.

Practice: answers

1. “Great beast”; it was as big as an elephant.
2. A giant lion. It really came from a ground sloth, Megalonyx.
3. Their long, curved claws kept them from putting their feet down flat.

2.9 THE LA BREA TAR PITS: FOSSILS IN THE CITY

OBJECTIVES

- Find Los Angeles on a map and tell what the La Brea Tar Pits are.
- Explain how sticky asphalt trapped animals and kept their bones.
- Name four animals whose fossils have been found at La Brea.

Warm-up. Put a spoonful of honey or syrup on a plate. Press your fingertip in and pull it out slowly. Feel how it holds on? Now imagine a pool of something much stickier that could hold a mammoth's foot.

Video slot. Video coming. The La Brea Tar Pits for children: how the asphalt trapped animals, the fossil lab and Project 23. Search approved channels (La Brea Tar Pits and Museum, Natural History Museum of Los Angeles County, Smithsonian); preview first.

KEY TERMS

asphalt

Thick, sticky, black oil that oozes up from the ground. People often call it tar.

seep

A place where a liquid slowly oozes up out of the ground.

dire wolf

A big wolf, heavier than a gray wolf, whose bones are the most common large fossils at La Brea.

excavate

To dig carefully to uncover something buried, like fossils.

CORE IDEAS

The story. In the middle of the big city of Los Angeles, California, cars rush past a grassy park. But in the park is a dark pond that bubbles: *plop ... plop*. Shiny black **asphalt** oozes up out of the ground in sticky puddles. At the edge of the pond stand statues of mammoths. Under the grass lie millions of fossils.

Known for a long time. The people who lived there long ago, the Tongva and the Chumash, used the sticky asphalt to seal their baskets and canoes so they would not leak. In 1769, Spanish explorers wrote about springs of tar in their journals. In Spanish, *la brea* means “the tar.” Later, workers digging out the asphalt for roofs and roads kept finding bones. In 1913, scientists began to **excavate**, and they pulled out thousands of bones.

A sticky trap. Asphalt **seeps** up through cracks in the ground. Sometimes leaves, dust or a shallow layer of water hid the sticky puddles. A horse or a bison stepped in and could not pull its feet out. Its calls brought wolves and big cats looking for an easy meal, and they got

stuck too. That is why La Brea has more meat-eaters than plant-eaters. Thousands of **dire wolves** have been found there, more than any other large animal, and more than two thousand saber-toothed cats.

What has been found. Scientists have found mammoths, giant ground sloths, camels, horses, bison, dire wolves, saber-toothed cats and huge birds like vultures. They have also found tiny things: insects, seeds, snails and bits of wood. In 2006, workers building a parking garage next door found so many fossils that they packed the dirt into 23 big wooden boxes, called Project 23. One box held a nearly complete Columbian mammoth, nicknamed Zed. Today you can visit the museum and watch scientists clean bones through a glass window.

Out of the pit. King David once felt stuck, like an animal in a sticky pit. Then he wrote, “He brought me up also out of an horrible pit, out of the miry clay, and set my feet upon a rock” (Psalm 40:2). We cannot pull ourselves out of sin by ourselves. God rescues us and sets our feet on solid ground.

PICTURE STUDY



Rancho La Brea Tar Pit, Charles R. Knight, 1921 · Oil on canvas (mural) · American Museum of Natural History, New York (hung in the Hall of the Age of Man)
Wikimedia Commons · Public domain

Charles R. Knight painted this mural to show what scientists thought the La Brea Tar Pits looked like long ago. He used the bones found in the tar to help him paint each animal. It hung in a museum in New York for more than forty years.

Look closely

- Find the ground sloth. What is happening to it?
- Find the saber-toothed cats and the big birds in the tree. Why are they there?
- Look far into the background. What other animals can you find?

Talk about it

1. How does this painting help explain why La Brea has so many meat-eaters?
2. What would you paint differently if you painted La Brea today, with the city around it?

Safety first. Use only cold kitchen syrup for the project and never heat it. Real asphalt seeps are sticky and can be hot in summer: at La Brea, stay behind the fences and never touch the tar.

HANDS-ON: TAR PIT IN A PAN

Make a sticky “tar pit” and find out how it traps animals.

You will need

- A baking pan
- Thick syrup (dark corn syrup or molasses), cold
- A few small plastic animals that can be washed
- A little water and a few dry leaves
- Paper towels and warm soapy water for cleanup

Steps

1. Pour a thin layer of syrup into the pan. This is your asphalt seep.
2. Gently pour a little water on top and scatter some leaves. Can you still see the sticky syrup?
3. Walk a plastic animal into the “pond.” Leave it a minute, then try to pull it out. What happens?
4. Walk a second animal toward the first one, as a hungry wolf would. Does it get stuck too? Wash everything in warm soapy water when you are done.

Check your work

- I made a tar pit that was hidden under water and leaves.
- I tested at least two animals.
- I can tell why so many meat-eaters were trapped at La Brea.

FIELD NOTEBOOK

1. Draw a cross-section: the ground, a sticky puddle on top, and bones buried below. Label “asphalt” and “fossils.”
2. Make a list of four animals found at La Brea and draw one.

Did you know? The name “La Brea Tar Pits” really says “the tar tar pits,” because *la brea* already means “the tar.” The bubbles in the pond are gas coming up from deep underground. The asphalt still oozes up today, and sometimes it pushes up through the lawns and sidewalks of the park.

 **What the sign says / What we observe / How Christians read it.**  **What the sign says:** “The fossils at La Brea are between about 11,000 and 50,000 years old.”

What we observe: bones of mammoths, sloths, wolves, cats and birds soaked in asphalt, still real bone and not turned to stone, along with insects, seeds and wood; many more meat-eaters than plant-eaters. **How Christians read it:** many young-earth Christians place the La Brea animals in the centuries after Noah’s Flood, during the Ice Age, about 4,000 years ago. They point out that the method used for these dates (carbon dating) assumes the amount of carbon in the air has stayed steady over time. Both can agree on what we see: these animals lived in what is now Los Angeles, and the sticky asphalt kept their bones.

Goes deeper in. Earth Science, the units on fossils, oil and the Ice Age (coming soon); Geography, for California; and History, for the Spanish explorers of California.

For families. This stop carries the  box. Facts are from the La Brea Tar Pits and Museum (Natural History Museum of Los Angeles County): the asphalt seeps were used by the Tongva and Chumash; the Portolá expedition recorded them in 1769; systematic excavation began in 1913; Project 23 began in 2006 with 23 crates and includes “Zed,” a Columbian mammoth. The museum reports thousands of dire wolves and more than 2,000 Smilodon. Mainstream radiocarbon dates for most La Brea fossils run from about 50,000 to 11,000 years. Knight’s mural shows a ground sloth stuck in the tar with predators nearby; the picture study keeps the talk gentle, so preview it with a sensitive child.

PRACTICE

1.  What does “la brea” mean?
2.  Why have more meat-eaters than plant-eaters been found at La Brea?
3.  Name four animals found at La Brea.

Make it a game • Stuck in the Tar. Mark a “tar pit” on the floor with a blanket. Players walk around the room. Anyone who steps on the blanket is stuck and must freeze with one foot on it. A stuck player may call out “Help!” and the next player who comes to help is stuck too! The last free player wins.

Scripture. “He brought me up also out of an horrible pit, out of the miry clay, and set my feet upon a rock, and established my goings.” (Psalm 40:2, KJV)

An animal in the tar could not get itself out. We cannot rescue ourselves from sin either, but God lifts us out and sets our feet on a rock.

Practice: answers

1. “The tar.”
2. When a plant-eater got stuck, meat-eaters came to eat it and got stuck too.

3. Any four: mammoth, ground sloth, camel, horse, bison, dire wolf, saber-toothed cat, vulture or other big birds, insects.

2.10 BUILD A MUSEUM DISPLAY

OBJECTIVES

- Name the parts of a good museum display: a specimen, a picture, a label and a story.
- Tell how Charles Willson Peale set up the first big fossil skeleton in America.
- Build a museum display about one animal from this trail, with an honest sign.

Warm-up. Think of a museum you have visited, or look at a museum website with a grown-up. What did you notice first: the bones, the pictures or the signs? What made you want to stop and look?

Video slot. Video coming. A behind-the-scenes look at how a museum builds a fossil display: preparing bones, making casts and writing labels. Search approved channels (Smithsonian National Museum of Natural History, Field Museum, American Museum of Natural History, La Brea Tar Pits and Museum); preview first.

KEY TERMS

specimen

A real object, such as a fossil bone, kept in a museum to be studied and shown.

cast

A copy of a fossil made by filling a mold, often with plaster.

label

A small sign that tells visitors what an object is and what we know about it.

curator

A person who takes care of a museum's collection and plans its displays.

CORE IDEAS

The story. In 1801, a painter named Charles Willson Peale heard that a farmer in New York had found giant bones in a muddy marsh. Peale traveled there and set up a huge wooden wheel. Men walked inside it like a hamster wheel to turn a pump that drained the water. Slowly, bone by bone, they dug out the skeleton of a mastodon, a cousin of the mammoth.

The first big display. Peale took the bones to his museum in Philadelphia. He carved wooden copies of the missing pieces and put the skeleton together so it stood tall. Crowds came to see it. It was the first fossil skeleton of a big animal ever set up in America. Peale was a good **curator**: he wanted every visitor to learn about the wonders of God's creation.

The parts of a display. A good museum display has four parts. A **specimen**, or a **cast** of one, shows the real thing. A picture or a model shows how the animal may have looked alive. A **label** tells its name, its size and where it was found. And a short story makes visitors want to learn more.

An honest sign. A good label tells visitors what we can see and measure, like “This tooth is 7 inches long.” If it tells what people think about the past, like how old something is, an honest label says so plainly. On this trail you have practiced keeping observations and interpretations apart. Now you will write your own sign.

Your museum. Choose one animal from this trail: an ichthyosaur, a plesiosaur, a mosasaur, a pterosaur, Quetzalcoatlus, a woolly mammoth, Smilodon, a ground sloth or a La Brea animal. Build a display about it and give your family a tour. “The works of the LORD are great, sought out of all them that have pleasure therein” (Psalm 111:2). A museum is a place for seeking out God’s works with delight.

PICTURE STUDY



The Artist in His Museum, Charles Willson Peale, 1822 · Oil on canvas · Pennsylvania Academy of the Fine Arts, Philadelphia
Wikimedia Commons · Public domain

When he was 81 years old, Charles Willson Peale painted himself inviting visitors into his museum. He lifts a heavy curtain to show the long room full of birds and animals. At the side, you can see some of the mastodon bones he dug up in 1801.

Look closely

- Find the curtain. What is Peale doing with it?
- Find the big bones. What else is near them?
- Look down the long hall. How are the birds displayed?

Talk about it

1. Why do you think Peale painted himself welcoming you in?
2. What would you put first in your museum, so visitors want to come inside?

HANDS-ON: MY TRAIL E MUSEUM

Build a museum display about one creature from this trail, and give a tour.

You will need

- Your clay model, chalk drawing, paper tooth or other project from an earlier stop (or a new drawing or clay model)
- A shoebox or a corner of a table
- Index cards and a pencil
- Crayons or colored pencils
- A small “rock” or real fossil if you have one (optional)

Steps

1. Choose your animal. Set your model or drawing in the shoebox or on the table. Add sand, blue paper for the sea or cotton for snow.
2. Draw a picture card of how the animal may have looked alive.
3. Write a label card with four lines: the name, how big it was, where its fossils are found and one true, surprising fact.
4. Write a second card in two parts: “What we observe” and “What people think.” Put one sentence under each.
5. Invite your family to your museum. Lift a “curtain” (a towel) like Peale and give them a tour.

Check your work

- My display has a model or drawing, a picture of the living animal and a label.
- My second card keeps “What we observe” apart from “What people think.”
- I gave a tour to at least one person.

FIELD NOTEBOOK

1. Draw your finished museum display and give it a title.
2. Copy your label card into your Field Notebook.

Did you know? Peale’s mastodon was only the second big fossil skeleton ever set up to stand in the world. The first was the Megatherium in Madrid (Stop E8). The Peale family is said to have held a small dinner party at a table set up under the mastodon’s ribs!

 **What the sign says / What we observe / How Christians read it.**  **What the sign says:** real museum signs often give a date, such as “This mammoth lived 20,000 years ago” or “This mosasaur lived 70 million years ago.” **What we observe:** the bones themselves, their size and shape, the rock or tar they were found in and where they were dug up. **How Christians read it:** many young-earth Christians read these creatures as made in the creation week, with many buried in Noah’s Flood and others living in the Ice

Age after it, thousands of years ago. A good sign, and a good student, can tell the observation apart from the interpretation. On your own sign, write what you observe first.

Goes deeper in. Art, for drawing and display; History, for Charles Willson Peale and early America; and Trail D, Stop D8 “Reading a museum sign.”

For families. This stop carries the ⏳ box. Peale excavated the mastodon on John Masten’s farm near Newburgh, New York, in 1801, using a large treadwheel-driven chain pump, and exhibited it in Philadelphia from 1801–1802; he painted the scene *The Exhumation of the Mastodon* (1806–1808, Maryland Center for History and Culture). *The Artist in His Museum* (1822) is at the Pennsylvania Academy of the Fine Arts. Calling it the second mounted fossil skeleton (after the Madrid Megatherium) follows common museum histories. The dinner under the ribs is a well-known family story (usually dated 1801–1802) whose details vary between accounts, so the stop says “is said to.” The museum display may reuse any earlier project from this trail, so the stop can be finished in 15–25 minutes or extended.

PRACTICE

1. **EASY** Name the four parts of a good museum display.
2. **MEDIUM** How did Peale get the mastodon bones out of the wet marsh?
3. **MEDIUM** Is “This tooth is 7 inches long” an observation or an interpretation?

Make it a game • Museum Guide. One player is the museum guide. Everyone else closes their eyes while the guide sets out three objects from the house. The visitors open their eyes and the guide gives a one-sentence label for each: one true observation about it. Then the visitors guess what each object is used for. Take turns being the guide.

Scripture. “The works of the LORD are great, sought out of all them that have pleasure therein.” (Psalm 111:2, KJV)

People who love God’s works enjoy searching them out. A museum is a place to seek out the great works of the LORD with delight.

Practice: answers

1. A specimen (or cast), a picture or model of the living animal, a label and a short story.
2. He built a big wheel that men walked in to run a pump and drain the water.
3. An observation: anyone can measure it.

TRACK 2 BADGE QUIZZES

The badge quizzes are optional. Read each question aloud; the child may answer by talking, pointing or drawing. Four right out of five earns each badge. Badges and the certificate are earned by doing the stops, not by scores.

Badge quiz 1 (Stops 1–5)

1. How were ichthyosaur babies born?
2. Where did Cope put the head of *Elasmosaurus* by mistake?
3. What kind of animal was a mosasaur?
4. What held up a pterosaur's wing?
5. Where was *Quetzalcoatlus* found, and how wide were its wings?

Badge quiz 2 (Stops 6–10)

6. Name two ways a woolly mammoth was made for the cold.
7. Was the saber-toothed cat a tiger?
8. What did Thomas Jefferson first think his giant claw came from?
9. Why did La Brea trap so many meat-eaters?
10. Name two things a good museum label tells.

TRAIL CERTIFICATE: MY SEA, SKY AND ICE AGE NOTEBOOK AND TRAIL E CERTIFICATE

Gather the Field Notebook pages from this trail into one booklet with a cover: "My Sea, Sky and Ice Age Notebook," your name and the dates you started and finished.

Add a photo or drawing of your museum display from Stop E10, with a copy of its label.

Add a "Sea, Sky, Ice" page: draw one sea reptile, one flying reptile and one Ice Age animal, each with its name.

When the booklet is done, a parent signs the Trail E certificate.

- **Ten stops:** At least one page for each stop, each with a title and a date.
- **Museum display:** A display with a model or drawing, a picture of the living animal and a label, shown on a tour.
- **Observe or interpret:** The child can tell what we observe from what people think on a museum sign.
- **Care:** Drawings are labeled and done carefully.

Answer key

1. Alive, right in the water, as dolphins are.
2. On the end of its tail.
3. A giant sea lizard, a cousin of monitor lizards like the Komodo dragon.
4. One very long finger (the fourth), with skin stretched from it to the leg.
5. In Big Bend National Park, Texas; about 33 to 36 feet, as wide as a small airplane.

6. Any two: two coats of hair, small ears, a short tail, a layer of fat, a fat hump.
7. No. Smilodon was a cat of its own kind.
8. A giant lion; it was really a ground sloth, Megalonyx.
9. They came to eat stuck animals and got stuck in the asphalt too.
10. Any two: the animal's name, its size, where it was found, a true fact; and it keeps what we observe apart from what people think.