EDUCATOR'S GUIDE

AMERICAN MUSEUM OF NATURAL HISTORY

DINOSAUR GALLERY

COSI®
Center of Science and Industry

MAP of the exhibition

KEY

- case/model
- interactive
- hands-on
- video

1 THEROPOD BIOMECHANICS:

How fast could T. rex run? A 3D mechanical T. rex, designed to simulate how this enormous animal actually moved, provides some clues.

2 SAUROPOD BIOMECHANICS:

Could huge animals such as Apatosaurus hold their necks and tails high? Scientists useengineering principles, complex computer models, and the study of living animals to investigate this question.

3 TRACKWAYS:

Dinosaur trackways can reveal hearding or migration behavior. The trackway recreated here from in Texas, Davenport Ranch, invites visitors to interpret a variety of dinosaur prints.

4 DISPLAY OR DEFENSE:

What purpose did dinosaurs' elaborate horns and frills serve? An impressive "trophy wall" of ceratopsian and other dinosaurs skulls, as well as horns and antlers from living animals, provide context for the debate over function.

5 LIAONING DIORAMA:

Exceptionally preserved fossils discovered in the Liaoning Province in northeastern China have enabled scientists to reconstruct plants and animals in stunning detail. A vivid diorama introduces topics such as the process of fossilization, feathered but flightless dionsaurs, and the origin of flowering plants.

6 EXTINCTION:

What happened 65 million years ago that caused the extinction of over half of living plants and animals? Research suggests that the answer is complicated: a combination of a massive meteorite impact, volcanism, and extreme climate changes.

7 NESTS, EGGS, & BABIES:

Some ancient dinosaurs made nests, laid eggs, and tended to their babies—just like today's birds and crocodiles.

8 BRAINS, LUNGS, & HEARTS:

New technology is revealing that the physiology and anatomy of dinosaurs and birds are more alike than once thought.

9 BONES, BEAKS, & CLAWS:

Modern birds still boast talons and hollow bones, callbacks to their evolutionary link to ancient dinosaurs.

10 FEATHERS AND FLIGHT:

Scientists think that many dinosaur species sported primative feathers - precursors to those birds use to fly, court mates, and more.

11 THE NEW AGE OF DINOSAURS:

There are perhaps over 18,000 species of birds that are alive today. Scientists look to these modern species for glimpses of their theropod ancestry.

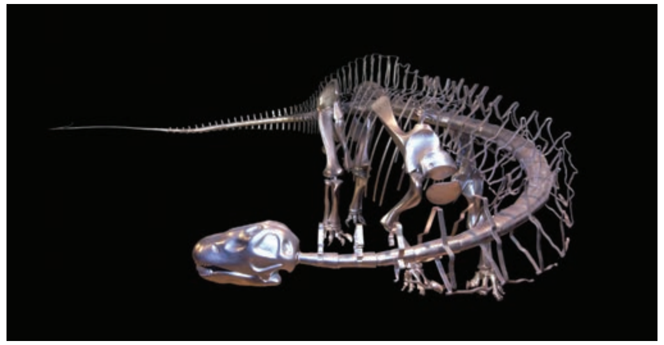
What new evidence is there for the scientific understanding of dinosaurs?

Scientists develop explanations using observations (evidence) and what they know about the world (scientific reasoning). This exhibition presents several types of evidence for new theories about dinosaurs:

NEW FOSSILS. Since the early 1990's, thousands of ancient plants and animals have been discovered in the Liaoning Province in China. One of these fossils is *Dilong paradoxus*, a primitive cousin of the *Tyrannosaurus rex*, which is covered in feathers. This find reinforces the idea that birds are living dinosaurs. Other fossils, like the juvenile *Psittacosaurus* found in the belly of a primitive mammal fossil, call into question the theory that mammals were much smaller and not in competition with dinosaurs.

Dilong paradoxus, a smaller cousin of *T. rex.*

NEW TECHNOLOGY. Scientists today use computer-based technology to enhance the gathering and manipulation of data, particularly when dinosaur skeletons are incomplete, or too fragile (and heavy) to handle. The exhibition's 3D mechanical *Tyrannosaurus rex* shows a rendering of how this giant actually moved, and an aluminum *Apatosaurus* model simulates this enormous creature's range of motion.



Full scale aluminum *Apatosaurus.*

Modern birds like chickens provide information about how extinct dinosaurs moved.

NEW WAYS OF LOOKING AT OLD FOSSILS. Scientists study modern animals for clues about the behavior of ancient dinosaurs. Because non-avian dinosaurs have been extinct for at least 65 million years, understanding behavior and movement poses a real challenge. Scientists observe movement, tracks, and morphological features in living species, from chickens to crocodiles, in order to flesh out what we know about ancient animals such as extinct dinosaurs.

What technological tools help scientists make more precise measurements and observations?

For centuries paleontologists have relied on tools such as hammers, shovels, and compasses. But now scientists also study dinosaurs with everything from satellite technology to scanning electron microscopes. These technologies are helping paleontologists piece together more of the dinosaur puzzle than ever before. The accuracy and precision of the data, and therefore the quality of the exploration, depends on the technology used. These technologies help paleontologists:

DISCOVER FOSSILS FASTER. GPS systems help scientists navigate to new dig sites and relocate existing ones.

EXAMINE DINOSAUR LOCOMOTION. Computer-generated models replicate dinosaurs' speed, movement, and range of motion.

SIMULATE DINOSAUR BEHAVIOR. Scientists are using computer models to simulate dinosaur herding behavior based on fossilized dinosaur tracks.

PEER INSIDE FOSSILS. Scientists can look inside fossils, like the fragile skull of the feathered *Bambiraptor*, without breaking them, thanks to advanced imaging technology such as digital x-rays and CAT scans.

A 3-D mechanical *T. rex* sheds light on biomechanics.

Is our understanding of dinosaurs complete?

Scientific knowledge evolves over time, building on earlier knowledge. Many theories about dinosaurs are undergoing major revision, such as:

DINOSAUR EXTINCTION. For decades the leading theory about the extinction of dinosaurs was that a huge asteroid or comet slammed into Earth 65 million years ago, setting off global wildfires and blocking sunlight. In recent years, however, researchers have also been investigating whether other forces contributed to a drastic change in the environment, such as massive volcanic eruptions and changes in sea level.

SPEED AND RANGE OF MOVEMENT. About a century ago, *T. rex*'s discoverers wrote of its "destructive power and speed." Within decades, though, scientists had decided that all large dinosaurs, including *T. rex*, were sluggish giants. Later, views changed again, and *T. rex* regained its reputation as a fast, fierce carnivore. These days, *T. rex* may be slowing down once more. Recent biomechanical analysis suggests that while *T. rex* was a powerful, even "destructive" animal, it was not very fast.

FRILLS AND HORNS. Researchers have long wondered about the purpose of particular dinosaur features like the bony horns, crests, and plates sticking out of their backs. For years, paleontologists thought these features served to protect the animal in battle. More recently, scientists have come to another conclusion: some of the features were used by dinosaurs in competition for mates.

How do scientists learn about life so long ago?

Paleontologists do much more than dig for and assemble dinosaur bones—they develop innovative ways of solving problems, posing questions, and obtaining data. Scientists formulate and test their explanations of dinosaurs using:

OBSERVATION. It is more than just a keen eye. Paleontologists determine what to observe and how to apply those observations. For example, paleontologists observed male bighorn sheep engaged in head-to-head combat to determine whether horned *Pachycephalosaurus* fought in the same way. Comparing the skulls of the two animals didn't provide enough information to determine their behavior.

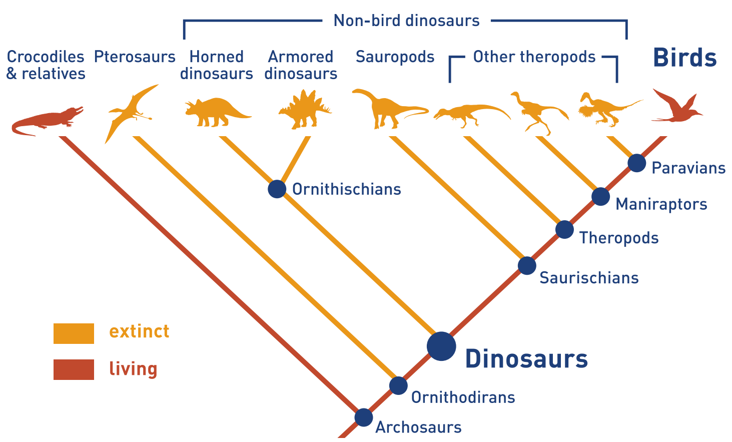
EXPERIMENT. Birds are living dinosaurs, so studying the way large modern ground birds—ostrich, emu and rhea—walk and run can help scientists interpret extinct dinosaur footprints. Experimenters got the birds to walk across a footprint-friendly surface, and then photographed and measured the results.

MODEL. After astronomers recorded a comet crashing into Jupiter in 1994, computer scientists have modeled the collision to show what might have happened when a meteor hit Earth. Models help scientists visualize and extrapolate from events that cannot be directly observed.

DINOSAUR FAQ

What are dinosaurs?

Dinosaurs are a group of animals that includes both birds, from hummingbirds to ostriches, and non-bird dinosaurs like *T. rex* and *Stegosaurus*. A feature that distinguishes most dinosaurs from all other animals is a hole in the hip bone, which helps them to stand upright—unlike crocodiles, which are the closest living relatives of birds.



The group called Dinosauria includes the extinct dinosaurs and all their living descendants. All its members, including living birds, descended from the very first dinosaur—their common ancestor. That's why birds are a kind of dinosaur (just as humans are a kind of primate).

The earliest known dinosaur occurred over 228 million years ago (mya). Dinosaurs evolved into a very diverse group of animals with a vast array of physical features. There were small, feathered carnivorous dinosaurs such as *Xiaotingia*, and massive herbivorous dinosaurs like titanosaurs. The first bird, a kind of **theropod** dinosaur, appeared during the Jurassic Period (about 150 mya). This is the common ancestor of all birds. With perhaps as many as 18,000 species alive today, birds—the only living dinosaurs—now occupy every continent and almost every ecological niche.

What is the evidence that birds are dinosaurs?

Birds have features and behaviors that are seen in non-bird dinosaur **fossils**:

FEATHERS. Birds are the only living animals with feathers, which were once thought to have evolved specifically for flight. The discovery of more and more feathered non-flying dinosaurs disproved that theory. Feathers serve many functions besides flight, including locomotion, insulation, protection, and display.

NESTS AND EGGS. Nest-building, egg-laying, and brooding are regarded as quintessential bird traits, but evidence of these behaviors has been observed across groups of non-bird dinosaurs. Well-preserved fossils, like this one of the non-bird dinosaur Citipati, reveal that it demonstrated a behavior—parental care—common to nearly all living birds.

This rare fossil, known as **Big Mama**, preserves a moment in time. The *Citipati* died spreading its forearms to protect its eggs. Birds today assume the same position when brooding their eggs.

INTERNAL ORGANS. Soft tissue, such as brains, is almost never preserved in the fossil record—but imprints sometimes are. Non-bird dinosaurs that were closely related to birds had particularly large brains that filled the entire braincase and left imprints on the inside of their skulls. Scientists are now using digital scans of fossil skulls to determine the size and shape of dinosaur brains, which contain important clues to how the animal functioned in the world. When scientists compare these findings to the brains of living birds, they find surprising similarities and intriguing differences.

Scientists use computed tomography (CT) scans of dinosaur skulls to create detailed 3D reconstructions of their interiors. This one shows the space inside the skull of *Archaeopteryx*, an early bird.

The more comparisons we make between birds and their closest non-bird dinosaur relatives, the more connections we find.

How do scientists piece together the story of dinosaur evolution?

To understand the history of life on Earth, scientists look at evidence from both living and extinct species. To learn about ancient life, scientists collect and study fossils. They also study living birds and their reptilian relatives—their anatomy, genetics, and behavior—for insight into how they are related to each other. This process—comparative biology—is a powerful approach to understanding evolutionary history. Scientists organize and interpret all of this evidence in order to figure out the place of dinosaurs, including birds, on the tree of life.

OHIO STATE STANDARDS

KINDERGARTEN

K.LS.1 Living Things are different than non-living things.

K.PS.1 Objects and materials can be sorted and described by their properties.

K.LS.2 Living things have physical traits and behaviors that influence their survival.

FIRST GRADE

1.LS.1 Living things have basic needs, which are met by obtaining materials from the physical environment.

1.LS.2 Living things survive only in environments that meet their needs.

SECOND GRADE

2.LS.2 Some kinds of individuals that once lived on Earth have completely disappeared, although they were something like others that are alive today.

THIRD GRADE

3.ESS.1 Composition of Soil and Rocks.

3.LS.1 Offspring resemble their parents and each other.

3.LS.2 Individuals of the same kind differ in their traits and sometimes the differences give individuals and advantage in surviving and reproducing.

3.LS.3 Plants and animals have life cycles that are part of their adaptations for survival in their natural environments.

FOURTH GRADE

4.ESS.3 The surface of Earth changes due to erosion and deposition.

4.LS.1 Changes in an organism's environment are sometimes beneficial to its survival and sometimes harmful.

4.LS.2 Fossils can be compared to one another and to present day organisms according to their similarities and differences.

FIFTH GRADE

5.LS.1 Organisms perform a variety of roles in an ecosystem.

5.LS.2 All of the processes that take place within organisms require energy.

SIXTH GRADE

6.ES.0 Classifying and identifying different types of rocks, minerals and soil can decode the past environment in which they formed

SEVENTH GRADE

7.LS.2 In any particular biome, the number, growth and survival of organisms and populations depend on biotic and abiotic factors.

EIGHTH GRADE

8.ESS.3 Evidence of the dynamic changes of Earth's surface through time is found in the geologic record.

8.LS.1 Diversity of species occurs through gradual processes over many generations. Fossil records provide evidence that changes have occurred in number and types of species.

8.LS.2 Reproduction is necessary for the continuation of every species.

8.LS.3 The characteristics of an organisms are a result of inherited traits received from parent(s).

HIGH SCHOOL

HS.BIO.EVOLUTION Mechanisms of natural selection, genetic drift, and history of life on earth.

HS.BIO.DIVERSITY Classification systems are frameworks created by scientist for describing the vast diversity of organisms indicating the degree of relatedness between organism.

HS.ES.EARTH SYSTEMS Evolution and adaptation in populations, biodiversity, geologic events and processes

HS.GEO.EARTH'S HISTORY The geologic rock record, climate changes evident through the rock record, fossil records

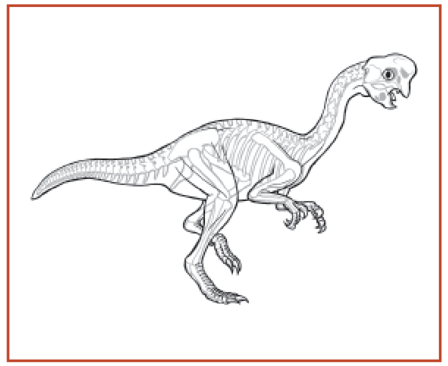
PRE-VISIT ACTIVITES

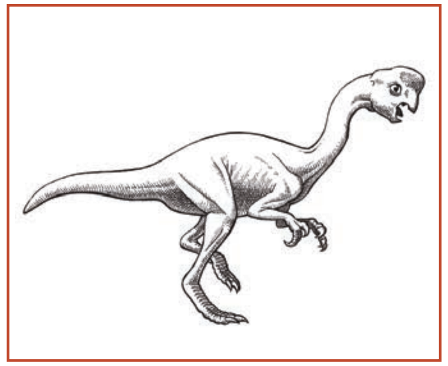
Flesh Out A Fossil

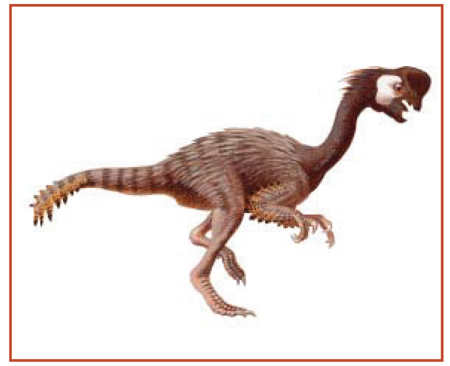
How do artists start with a skeleton and turn it into a realistic animal drawing?

After finding and reconstructing a dinosaur skeleton, scientists often work with artists to recreate what the animal may have looked like in real life. **Take a look at the steps that artists use to create a lifelike dinosaur.**

OVIRAPTOR







1. ADD A BODY

Using a pencil and tracing paper, outline where you think the dinosaur's muscles and flesh might have been. Show the shape of the arm and thigh and how they attach to the body.

Tip: Think about whether some areas on the dinosaur's body have more flesh than others. Also think about living animals with a similar body form, like a chicken or ostrich.

2. ADD SHADING

Use short, light strokes to create shadows to make your dinosaur look more lifelike. Use firmer strokes to refine the dinosaur's outline, eyes, nostrils, and claws.

Tip: Pretend a light is shining from the upper left corner. Where would the shadows be?

3. ADD DETAILS

Add skin texture, feathers, or scaly skin. Then color your dinosaur.

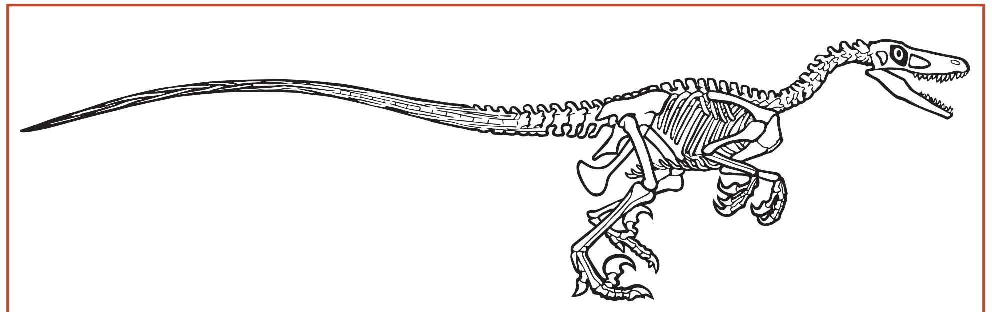
Tip: Use your imagination! Some dinosaurs had scaly skin; some had feathers. Pick a color (or colors) you think this animal may have had.

FUN FACT

Fossilized feathers have been found on several species of extinct carnivorous dinosaurs. These feathers were not used for flight, but for show and warmth.

Now It's Your Turn!

Follow the steps to flesh out this Velociraptor skeleton.

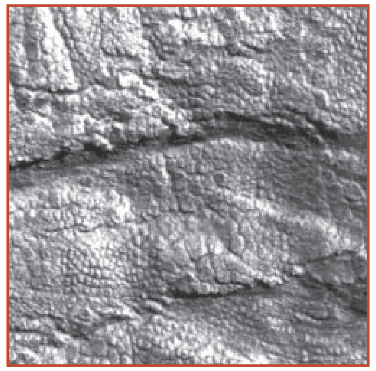


What Is A Fossil?

Introduction

The American Museum of Natural History houses the largest and most spectacular collection of vertebrate fossils in the world. A fossil is any evidence of prehistoric life that is at least 10,000 years old. The most common fossils are bones and teeth, but footprints and skin impressions fossils as well. Fossils are excavated from ancient riverbeds and lakes, caves, volcanic ash falls, and tar pits.

Fossils are classified as either body fossils or trace fossils. Body fossils were parts of the organism, such as bones or teeth. Trace fossils include foot impressions, eggs, burrows, and dung.



an impression of dinosaur skin

OBJECTIVE

In this activity, students will learn to distinguish between body fossils and trace fossils.

MATERIALS

- Body Fossils and Trace Fossils duplicated for each student
- Crayons
- Pictures of fossils

foot of *Tyrannosaurus rex*

PROCEDURE

1. Write the word fossil on the chalkboard and have students describe what a fossil is in their own words. Guide students to understand that a fossil is any evidence of life that is at least 10,000 years old. Further explain that non-avian dinosaur fossils are much older. Some are 65 million years old, others are more than 225 million years old. Tell students that paleontologists can learn a lot about life long ago by studying the fossils they find. Tell students they will explore different kinds of fossils.

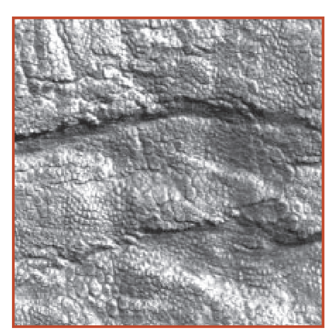
2. Write the words body and trace in two columns on the chalkboard. Tell students that fossils are classified as body fossils and trace fossils. Body fossils were once part of an animal. Display pictures of the body fossils. Have students identify the skull, tooth, and foot. Write their answers in the column marked "body." Further explain that trace fossils are evidence of something the dinosaur left behind. Display pictures of the trace fossils. Have students identify the footprints, eggs, and skin impression. Write their responses in the column marked trace. Allow students time to share other information they have about fossils.

3. Distribute crayons and copies of **Body Fossil and Trace Fossils**. Instruct students to look at the fossils pictured and decide whether they are body fossils or trace fossils. Have them circle the body fossils blue and the trace fossils red. (Answers: tooth, skull, and foot are body fossils. Skin imprint, eggs, and footprints are trace fossils.)

Body Fossils and Trace Fossils

Name: ______________________________ Date: ____________________

Look at the fossils below. Circle the body fossils BLUE. Circle the trace fossils RED.



How Dinosaurs Lived?

What did an ancient dinosaur's world look like? Step back in time—about 130 million years—to a part of eastern Asia now known as Liaoning ("lee-ow-NING"), China. Here, in fossilized lakebeds, scientists have uncovered thousands of fossil remains: including plants, insects, frogs, fish, small mammals, and even feathered dinosaurs! Together this collection creates a more complete picture of what a dinosaur ecosystem (its community of plants, animals, landscape, and weather) probably looked like. How did these animals and plants live together? Check out the illustrations below of Liaoning species discovered. Then answer the questions in "Eco-Quest" to the right.

A. *Eomaia scansoria* ("eeoh-MY-ah SCAN-sor-eeah"), ancient mammal

B. *Sinosauropteryx prima* ("SIGNno-sore-AHP-ter-ix PREE-ma"), feathered dinosaur

C. *Confuciusornis sanctus* ("con-FEW-shis-OR-nis SANK-tus"), flying bird with toothless beak

D. *Dilong paradoxus* ("dee-LONG pairuh-DOX-us"), feathered cousin *of T. rex*

E. *Water strider* insect

F. *Repenomamus giganticus* ("ra-pen-o-MAM-us ji-GAN-tehkus"), cat-sized primitive mammal

G. *Archaefructus* and ***Rehezamites*** trees

H. *Psittacosaurus* ("se-TACK-ah-sor-us"), a herbivorous dinosaur

ECO-QUEST

1. What similarities can you find between the bird (*Confuciusornis sanctus*) and *Sinosauropteryx prima* or *Dilong paradoxus* dinosaurs? Are you surprised by the similarities? Why or why not?

2. Scientists believe that *Dilong paradoxus* had a thin coat of feathers, but like its featherless cousin, the *T. rex*, it couldn't fly. What function do you think its feathers served? Think about what modern animals use feathers for.

3. *Repenomamus giganticus* was a carnivorous mammal about the size of a cat. From the plants and animals pictured here, what do you suppose it ate? (Hint: It wasn't insects.)

4. Scientists studied plant fossils and determined that the Liaoning Forest was warm and dry. What can you tell about the climate in your area from looking at trees and plants?

FUN FACT

If dinosaurs didn't swim, how come their fossils were found in this fossilized lakebed? Dinosaurs were washed into the lake after they died. They were then quickly buried in ash from nearby volcanoes. Because the remains were preserved so rapidly, many of the Liaoning fossils show almost the entire organism, including its hair, feathers, and what it ate for dinner!

ANSWERS
1. Birds and dinosaurs are both bipedal (walk on two legs), have similar hands and feet, small skulls, and feathers. Birds and dinosaurs share a common ancestor. 2. Modern birds use feathers for flight, display, camouflage, and insulation (warmth). These feathers probably insulated the dinosaur. 3. Baby and smaller dinosaurs! 4. Answers may vary.

IN THE EXHIBIT

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POST-VISIT ACTIVITIES

Measure Human Trackways

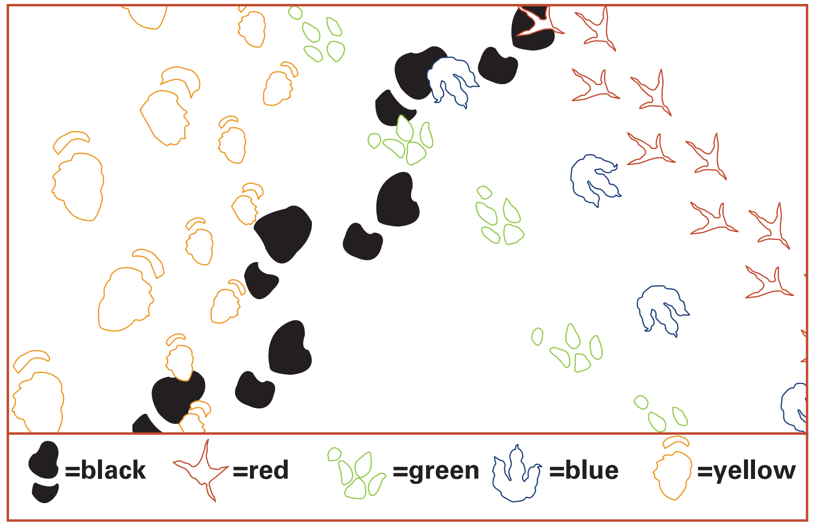
What can we learn from looking at dinosaur trackways? There is a lot we can not tell, like the size, color, and sex of the dinosaurs which made the tracks. One of the things that paleontologists can tell from looking at a dinosaur track is whether the dinosaur was running or walking.

HAVE YOUR STUDENTS TRY THIS ACTIVITY TO SHOW THE DIFFERENCE:
Roll out a sheet of butcher block paper on the floor. Lay a large casserole tin or Tupperware container on the floor next to it, and fill it roughly halfway with water. Have a student take off her shoes, dip her bare feet in the container of water, and walk over the paper. Then have her dip her feet again and carefully run over the same paper. For each set of prints, measure her stride (the distance from toe to toe made by the same foot). What are the differences in her stride between the two sets of prints? Ask a student who is taller or shorter to repeat the same activity. Compare and contrast the footprints.

How Dinosaurs Behaved

Like today's crime-scene investigators, paleontologists study trackways—fossilized footprints—for clues about how dinosaurs behaved. For example, did they travel in herds, like elephants? Did some hunt alone? Did they migrate long distances in search of food, like modern caribou? Trackways often hold the key.

Look at this illustration. Let's say you are a paleontologist who has just come across these awesome clues, frozen in place from the days when non-avian dinosaurs roamed the Earth. What can you figure out about those long-ago creatures by studying their trackways? Color the different animals' tracks in different colors (we've done the first one for you) and then try to answer the following questions. (Keep in mind: You won't be able to answer all the questions with certainty.)



QUESTIONS:

1. How many different kinds of animals were here?
2. Did the animal that left the red tracks walk on two or four legs? Was it walking or running?
3. Did the animal that left the yellow tracks travel alone?
4. Which dinosaur walked across the area first?
5. How many individual animals were here?
6. If these animals were all here at the same time, can you make some guesses as to why?

FUN FACT

There is only one known footprint of the *Tyrannosaurus rex*. Scientists believe that the rarity of *T. rex* footprints (and fossils) means that there simply were not that many *T. rex* around. Modern animals at the top of the food chain—lions, eagles, great white sharks—tend to be rare as well.

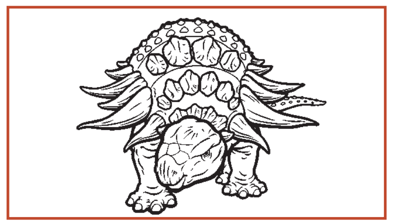
ANSWERS
1. Five. 2. Probably two legs and walking. 3. Probably not. 4. The one with the black tracks. 5. Probably six. 6. Answers may include: looking for food or water, migrating, escaping a predator.

POST-VISIT ACTIVITIES

How Dinosaurs Looked

Fancy frills, sharp horns, pointy spikes, massive sails on their backs—dinosaurs had them all! The question is: Why did dinosaurs sport these far-out features? For clues, scientists often compare dinosaur designs with those of modern animals. Check out this album of animal fashions. Try to guess what the features are for!

1. What is the function of the armor on these animals?



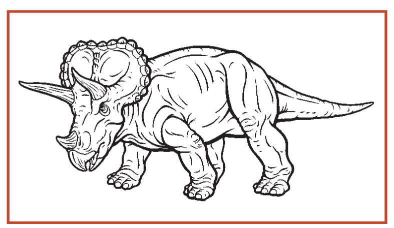
A. *Edmontonia*

B. Armadillo

CLUE

Weighing in at over 3.5 tons, *Edmontonia* had relatively short and muscular legs that supported a heavy load on its back. It also sported hornlike spikes on its sides.

2. What is the function of these horns and frills?



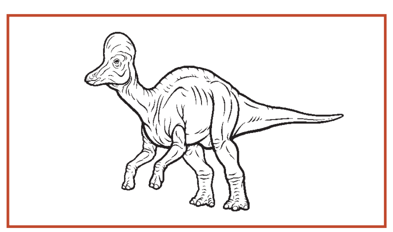
A. *Triceratops*

B. Rhinoceros

CLUE

A young *Triceratops* typically had smaller horns and frills. These features became fully developed only when the animal reached maturity.

3. What function did the *Hadrosaur* crest serve?



A. *Hadrosaur*

B. Cassowary

CLUE

Scientists think that the crest on the *Hadrosaur's* head may have been brightly colored. They also think it may have looked different in males and females.

FUN FACT

What color were dinosaurs? We don't know for sure, but scientists look to dinosaurs' closest relatives for clues. Reptiles and birds are often very colorful, so dinosaurs probably were, too!

WRAP-UP

Design your own dinosaur. Think about the features you would like your dinosaur to have. First, list its traits, then draw a sketch on paper. Why does your dinosaur look that way?

ANSWERS

1. Edmontonia's armored back was for self-defense; 2. Triceratops' horns and frills were to attract mates and compete with rivals; 3. Hadrosaur's crests were used to attract mates and recognize members of its own species, and possibly distinguish males from females.

GLOSSARY

Ankylosaur: a heavily built quadrupedal herbivorous dinosaur primarily of the Cretaceous period, armored with bony plates.

Archosaur: a reptile of a large group that includes the dinosaurs and pterosaurs, represented today only by the crocodilians.

Biomechanics: the study of the mechanical laws relating to the movement or structure of living organisms.

Brooding: sitting on eggs until they hatch.

Cenozoic: relating to or denoting the most recent era, following the Mesozoic era and comprising the Tertiary and Quaternary periods.

Ceratopsian: a gregarious quadrupedal herbivorous dinosaur of a group found in the Cretaceous period, including triceratops. It had a large beaked and horned head and a bony frill protecting the neck.

Cladogram: a branching diagram showing the cladistic relationship between a number of species.

Computed tomography (CT): a scanning process that combines many X-rays to produce a three-dimensional image.

Cretaceous: relating to or denoting the last period of the Mesozoic era, between the Jurassic and Tertiary periods.

Diapsid: a reptile of a large group characterized by the presence of two temporal openings in the skull, including the lizards, snakes, crocodiles, dinosaurs, and pterosaurs.

Dinosaur: a fossil reptile of the Mesozoic era, often reaching an enormous size.

Endo cast: a cast or impression of the interior of a hollow object.

Extant: still in existence; not extinct.

Extinct: (of a species, family, or other larger group) having no living members.

Fossils: the remains of ancient organisms such as teeth, bone, wood, or shell; or evidence of activity such as footprints and burrows.

Jurassic: relating to or denoting the second period of the Mesozoic era, between the Triassic and Cretaceous periods.

Mass extinction: the extinction of a large number of species within a relatively short period of geological time.

Mesozoic: relating to or denoting the era between the Paleozoic and Cenozoic eras, comprising the Triassic, Jurassic, and Cretaceous periods.

Ornithischian: relating to or denoting herbivorous dinosaurs of an order distinguished by having a pelvic structure resembling that of birds.

Paleozoic: relating to or denoting the era between the Precambrian eon and the Mesozoic era.

Primitive: original; the ancestral condition. Primitive traits precede advanced ones, which are more modified and less like the original condition.

Saurischian: relating to or denoting dinosaurs of an order distinguished by having a pelvic structure resembling that of lizards.

Sauropod: a very large quadrupedal herbivorous dinosaur with a long neck and tail, small head, and massive limbs.

Stegosaur: a small-headed quadrupedal herbivorous dinosaur of the Jurassic and early Cretaceous periods, with a double row of large bony plates or spines along the back.

Theropod: a carnivorous dinosaur of a group whose members are typically bipedal and range from small and delicately built to very large.

Trace fossil: a fossil of a footprint, trail, burrow, or other trace of an animal rather than of the animal itself.

Trackway: a path formed by the repeated treading of people or animals.

Triassic: relating to or denoting the earliest period of the Mesozoic era, between the Permian and Jurassic periods.

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