

DINOSAURS

A JOURNEY THROUGH TIME

TEACHER PRE-VISIT



EXHIBIT HIGHLIGHTS

Your students' journey through time begins right here in Pacific Science Center's robotic dinosaur exhibit. Eight half-size and full-size model dinosaurs from the Jurassic and Cretaceous periods fill a room with the distant roar of prehistory. Students can get an up close look at the anatomy of their favorite dinosaur, read about dinosaurs and dinosaur research, enjoy the miniature diorama collection, and touch a real dinosaur bone fossil. Warning: Look out for that T. Rex studying you from above!

DINOSAUR INFORMATION

Fossil evidence indicates that dinosaurs lived during an era of time called the Mesozoic (248 - 65 million years ago) which is divided into periods known as Triassic, Jurassic and Cretaceous. There are eight robotic dinosaurs in the **Dinosaurs: A Journey Through Time** exhibit. The period of their existence is listed along with an approximation of the time labeled as MYA (million years ago).

Pachycephalosaur "thick-headed lizard"

Late Cretaceous-70 MYA 20 ft long Herbivore

Its knobby, domed head was 8 to 10 inches thick making it less prone to decay and therefore more easily fossilized. While it is easy to speculate that this animal may have used its head as a butting weapon, no evidence yet exists of fractures or healed wounds on any of the specimens collected. Robot is full-size.

Deinonychus "terrible claw"

Early Cretaceous-105 MYA 9 ft long Carnivore

This predator likely hunted in organized packs. Its tail aided in balance and may have been used as a lever enabling it to change direction quickly. The middle toe of each hind foot had a sharp 5-inch claw used to slash at the bellies of prey. It is closely related to Velociraptor. Robot is full-size.

Allosaurus "strange (or "other") lizard"

Late Jurassic-150 MYA 35 ft long Carnivore

This large animal had a three-foot long head and hinged jaws that could open up unusually wide. Its eyes were twice as large as T. Rex. While most dinosaurs are known from just a few fossils, paleontologists have found fossils of 60 Allosauruses. Robot is half-size.

Parasaurolophus "similar to crested lizard"

Late Cretaceous-70 MYA 33 ft long Herbivore

This duck-billed animal had a long, hollow bony crest at the top of its head. Its nostrils went up through the crest and back down again, forming four tubes that may have been used to produce foghorn sounds. Fossilized stomach contents showed this animal ate pine needles, twigs and other land plants. Robot is half-size.

Tyrannosaurus Rex "tyrant lizard king"

Late Cretaceous-70 MYA 50 ft long Carnivore

At 50 feet long, T. Rex was one of the largest meat eaters ever to walk the Earth. Its large tail was held upright to counterbalance its heavy neck and jaws. T. Rex had bird-like hind feet and hollow bones. Robot is half-size.

Stegosaurus "plated lizard"

Late Jurassic-145 MYA 25 ft long Herbivore

While it is likely that the spikes on its tail were used as a defensive weapon, ideas about the functions of the plates on its back vary. They could have been solar heat collecting devices, mating displays or spine and flank protection. Robot is half-size.

Apatosaurus "deceptive lizard"

Late Jurassic-150 MYA 75 ft long Herbivore

Because a fossil specimen of an Apatosaurus was once misidentified as a new species, this dinosaur was mistakenly called Brontosaurus. At 30-35 tons this animal's bulk was formidable protection against predators such as 4 ton Allosaurus. Robot is half-size.

Triceratops "three-horned face"

Late Cretaceous-70 MYA 30 ft long Herbivore

This animal's frilled neck and horns may have served as protection from carnivores such as T. Rex. It apparently traveled in herds and parents may have cared for their young. Robot is half-size.



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PRE-VISIT DISCUSSION

- Make a list of the eight dinosaurs in the exhibit and have students list what they know about each one.
- Discuss how and what dinosaurs ate, how they moved and how they reproduced. How do we know these things?
- Scientists have developed many ideas about dinosaur evolution. One such idea presents strong evidence that dinosaurs did not become extinct entirely and modern birds are the descendents of dinosaurs, some of which, at the end of the Cretaceous, were quite like modern birds. Discuss what physical adaptations of these bird-like dinosaurs might have made their survival possible.

WHILE AT DINOSAURS: A JOURNEY THROUGH TIME

As appropriate, encourage chaperones to lead discussions within their field trip groups about the following:

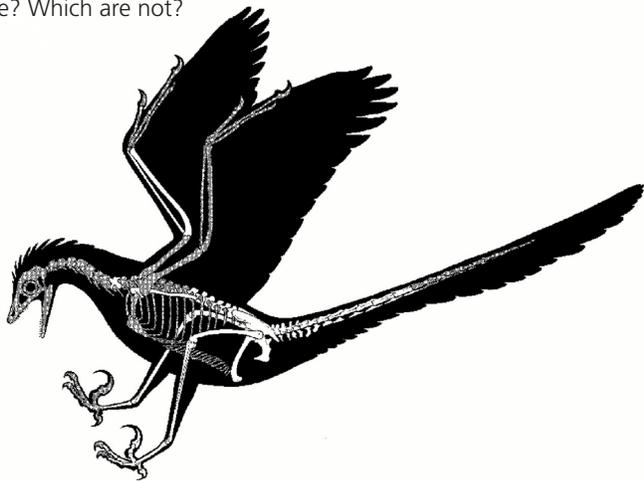
Dinosaur/Bird Connection

One of the current ideas about the evolution of dinosaurs suggests that modern birds are direct descendents of some dinosaurs, particularly theropod dinosaurs.

The more obvious characteristics of theropods are:

- three main fingers on the hands and three main weight-bearing toes on the feet
- recurved teeth useful for eating flesh
- claws present at the ends of all fingers and toes

Which dinosaurs in the exhibit are theropods? (*Deinonychus*, *T. Rex*, *Allosaurus*) Which features of those dinosaurs do you think are bird-like? Which are not?



This is a drawing, showing the skeleton, of a late Cretaceous dinosaur/bird called Rahonavis. Look closely. How is it like the theropods in the exhibit?

POST-VISIT DISCUSSION

- Review and amend any list you may have made of students' prior knowledge of dinosaurs.
- What questions about dinosaurs do students think have been adequately explored by paleontologists? Have students discuss what questions they would like to explore as a paleontologist and how they would go about it.
- Ask students to describe the environment and climate during the Cretaceous period (the last period of the Mesozoic era). Discuss their ideas of how a catastrophic event, such as a large meteorite impact, would effect the environment, climate and living organisms.

Essential Academic Learning Requirements (EALRs) for Washington state addressed in this flyer*:

EALR 4: Domains of Science: Life Science and Earth History

Big Ideas:

- Changes in ecosystems occur as a natural event. These changes affect living organisms.
- Animals can be sorted according to their structures and behaviors.
- In any ecosystem, some populations thrive, some decline and others do not survive.
- Fossils provide evidence that species have become extinct and that species change over time.

EALRs 1 & 2: Crosscutting concepts and abilities

Systems: Describe the effect on a system if its input is changed.

Inquiry: Ask and answer questions by making observations, or trying things out.

**To find out about EALRs addressed in the exhibit, please refer to the Dinosaurs: A Journey Through Time EALR chart in your package.*

Please feel free to use the Student Activity Sheet, in part or whole, as an on-site activity for your class.

DINOSAURS

A JOURNEY THROUGH TIME

STUDENT ACTIVITY SHEET



DINOSAUR BRIEFING DINOSAUR INFORMATION

In this exhibit there are eight robotic dinosaurs. These robots represent animals that lived from 195 million years ago to 64 millions years ago during the Jurassic and Cretaceous periods.

Fossil records show that dinosaurs both great and small dominated the earth for 180 million years. Also shown in the fossil record is that 65 million years ago dinosaurs, as we recognize them, vanished. There are many ideas about what caused this apparent extinction. The most dramatic theory is that an extremely large meteorite struck the earth causing global climate change leading to dinosaur extinction. This theory is well supported by evidence in the rock layers. The fossil evidence shows that some dinosaurs are more closely related to birds, rather than lizards. Some paleontologists (pey-lee-uhn-tol-uh-jist) now believe that some dinosaur species managed to avoid extinction 65 million years ago and may have evolved into our modern birds, which means that dinosaurs may not have become extinct at all. Think about that the next time you see a pigeon!

While modern dinosaur theory is supported by strong evidence, there are still many questions unanswered. Perhaps you can become a paleontologist and explore these interesting questions. Start today!

NAME GAME

Most dinosaurs get their names from Greek or Latin. Work with another student to see if you can guess what some of the dinosaur names are that match these meanings. Then read the exhibit signs to see how well you did.

Tyrant Lizard King: _____

Plated Lizard: _____

Deceptive Lizard: _____

Three-Horned Face: _____

Thick-Headed Lizard: _____

Terrible Claw: _____

Strange (Other) Lizard: _____

Similar to Crested Lizard: _____

Bonus: Which part of these names means "lizard"?

Why might "lizard" be a mistake to use for some dinosaurs?

Choose a dinosaur and draw a part of it here. You might choose the head, an eye, a claw or something else.

How does this part of the dinosaur help it survive?



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THINGS TO THINK ABOUT AND DO

- Ask three other students to name which of the exhibit dinosaurs they like best and why. Record the students' names and their answers here.

1. _____

2. _____

3. _____

- Look at the paintings, dioramas and settings around the dinosaurs. Read the signs. Write a description of how the earth looked and what the climate was like at the time of the dinosaurs.

- Paleontologists once believed that dinosaurs were lizards. Now scientists more commonly agree that some dinosaurs are closely related to birds. Look around at the robots and read the exhibit signs.

What features of the dinosaurs are like lizards?

What features of the dinosaurs are like birds?

Write the names of the dinosaurs you think are most like birds.

- Look at your favorite meat-eating (carnivore) dinosaur and favorite plant-eating (herbivore) dinosaur. List features of each that you think made them well-adapted to the foods they ate.

CARNIVORE

HERBIVORE

_____	_____
_____	_____
_____	_____

TAKE IT AWAY:

- Write one new fact you learned or something that surprised you today about dinosaurs. Share this with someone you live with.

