EDUCATOR RESOURCE GUIDE - DINOSAURS

Arizona Museum of Natural History
53 N Macdonald St
Mesa, AZ 85201
480.644.2230  AzMNH.org
Dear Teacher,

Welcome to the Arizona Museum of Natural History; we are pleased you have chosen to visit our museum. It is our goal to provide quality materials that adhere to the Arizona State standards, as well as helpful information and activities.

This packet is formatted to supply facts, timeline, flow charts and quick activities to support what is taught in the classroom. The information and materials provided in this packet can easily be modified for any K-8 curriculum.

We also believe your field trip to the Arizona Museum of Natural History will be more successful if students have prior knowledge of what they will be exploring. We know your time is valuable and we want to make your experience with us a pleasant one.

Feel free to download anything you would like to incorporate into your classroom activities. There is a chart to tell you which grade level standards are met by each activity.

If you have any questions, please don’t hesitate to call.

Sincerely,

Alice Jung
Educational Services Coordinator
Arizona Museum of Natural History
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**DINOSAURS**

**GOAL FOR VISIT**

To help understand the history of life on earth through the study of dinosaurs.

**Students Will Understand That:**
- The prehistoric world of the Mesozoic Era was very different from our own.
- Not everything that lived in the Mesozoic Era were dinosaurs.
- Dinosaurs and people did not live at the same time.
- The type of food eaten by a dinosaur can be known by the kind of teeth it had.

**Essential Questions**
- What was a dinosaur?
- What happened to the dinosaurs?
- How did dinosaurs become extinct?
- When and where did dinosaurs live?
- Do we know what color dinosaurs were?
- How do we know that dinosaurs once lived?

**Students Will Know:**
- How a fossil is formed.
- How scientists use scientific inquiry to study fossils.
- How dinosaurs are named.

**Vocabulary:**
- carnivore
- herbivore
- cast
- omnivore
- dinosaur
- paleontologist
- extinct
- paleontology
- fossil
- reptile

**Learning Plan**

**Pre Visit Activity**
- Post Visit Activity
- Discussion Questions
- Dinosaur Action Poem
- Dinosaur coloring Page
- Color by Letter Dino
- T is for Triceratops
- A Nest of Dinosaur Eggs Math Worksheet
- Creative Writing Ideas

**Post Visit Activity**
- Quick Dino Activities
- Making an Imprint Fossil
- Dinosaur Sizes Math Activity
- Dinosaur Poem
- Dinosaur Similes
- Dinosaur Unscramble
- Dinosaur Name Game
- The Great Dino Quiz
- Who Am I?

**Supports the Following Arizona State Standards**

**Science**
- Strand 1 The Inquiry Process Concepts 1, 2, 3, 4
- Strand 2 The History and Nature of Science, Concept 1
- Strand 4 Life Science, Concepts 1, 2, 3, 4
- Strand 6 Earth and Space Science, Concept 1

**Math**
- Strand 1 Number Sense and Operations, Concepts 1, 2, 3

**Reading**
- Strand 1 Reading Process, Concepts 2, 3, 4
- Strand 3 Comprehending Information in Texts, Concept 2

**Writing**
- Strand 1 Writing Process, Concepts 1, 2, 3, 4, 5
- Strand 2 Writing Elements, Concepts 1, 2, 3, 4, 5, 6
- Strand 3 Writing Applications, Concepts 1, 2, 6

**Arts**
- Strand 2 Beginning Dance Concept 3

*Please note: For information on field trip opportunities and the Educator Resource Guide for this subject, please call the Arizona Museum of Natural History’s group reservation line at 480-644-3553.*
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### KINDERGARTEN STANDARDS - BEGINNING DANCE

| 2 - Relate | 3 | Relating Dance and Literacy | 101 |

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## 2ND GRADE STANDARDS - SCIENCE

### 1 - Inquiry Process
1. Observations, Questions and Hypotheses 1 - 2
2. Scientific Testing 1 - 4
3. Analysis and Conclusion 1 - 4
4. Communication 1 - 2

### 2 - History and Nature
1. History of Science as Human Endeavor 2

### 4 - Life Science
1. Characteristics of Organisms 1
2. Life Cycles 3

## 2ND GRADE STANDARDS - MATH

### 1 - Number and Operations
3. Estimation 1

## 2ND GRADE STANDARDS - LANGUAGE ARTS READING

### 3 - Comprehending Info Text
1. Expository Text 2
2. Functional Text 1 - 2
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### 2ND GRADE STANDARDS - LANGUAGE ARTS WRITING

#### 1 - Writing Process
- 1 Prewriting 1 - 4
- 2 Drafting 1 - 2
- 3 Revising 1 - 3
- 4 Editing 1 - 2
- 5 Publishing 1 - 2

#### 2 - Writing Elements
- 1 Ideas and Content 1 - 2
- 2 Organization 1 - 5
- 3 Voice 1 - 2
- 4 Word Choice 1 - 3
- 5 Sentence Fluency 1 - 3
- 6 Conventions 1 - 11

#### 3 - Writing Applications
- 1 Expressive 1
- 2 Expository 1 - 2
- 6 Research 1

### 2ND GRADE STANDARDS - BEGINNING DANCE

#### 2 - Relate
- 3 Relating Dance and Literacy 101

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### 3RD GRADE STANDARDS - SCIENCE

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## 4TH GRADE STANDARDS - LANGUAGE ARTS WRITING

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2. Drafting 1 - 2
3. Revising 1 - 7
4. Editing 1 - 4
5. Publishing 1 - 5

### 2 - Writing Elements
1. Ideas and Content 1 - 3
2. Organization 1 - 6
3. Voice 1 - 2
4. Word Choice 4
5. Sentence Fluency 1 - 4
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### 3 - Writing Applications
1. Expressive 1 - 2
2. Expository 1 - 3
6. Research 1 - 3

## 4TH GRADE STANDARDS - BEGINNING DANCE

2. Relate
3. Relating Dance and Literacy 201
The earth was very different 200 million years ago. The climate was warm and mild in most places. A shallow sea had retreated to the western edge of what would become North America. The Rocky Mountains had not yet formed and flowering plants were just beginning to appear among the lush ferns and cycads. Tiny shrew-like mammals scurried in the undergrowth, along with quick-footed lizards. But by far the most dynamic and dominant land animals at this time were the dinosaurs, a special group of prehistoric reptiles.

**What is a Dinosaur?**

- Dinosaurs are animals that evolved into many sizes and shapes from a group of crocodile-like reptiles called **thecodonts**.

- The word dinosaur means “terrible lizard.”

- Dinosaurs lived during the Mesozoic Era, from the late Triassic Period, beginning about 230 million years ago (mya), until the end of the Cretaceous Period, 65 million years ago, according to fossil finds.

- Dinosaurs lived throughout the Mesozoic Era. There were three distinct periods, the Triassic from 250 to 206 mya, the Jurassic from 206 to 144 mya and the Cretaceous from 144 to 65 mya. Different dinosaurs lived during the different periods.

- Dinosaurs varied in size. One of the largest, the *Brachiosaurus*, was over 70 feet long and up to 40 feet tall. In contrast, *Compsognathus*, was 2 feet long and weighed about 6.5 pounds, approximately the size of a chicken.

- Dinosaurs were **carnivores** (meat eaters), **herbivores** (plant eaters) or **omnivores** (both meat- and plant eaters).

- We can determine the diet of a dinosaur by the shape of its teeth. Most carnivores had sharp, serrated teeth for ripping and tearing. Some, like the ornithomimids, had no teeth at all. Herbivores had teeth that were adapted to their diet. Most had sharp, scissor-like teeth for shearing off plant material. Some had peg-like teeth to strip the leaves or needles from a twig or branch. A few had flat teeth used to grind fibrous plant.

- Like many of today’s reptiles and sharks, dinosaurs could grow replacement teeth throughout their lives.
**Fun Dino Fact:** Hadrosaurs ("bulky lizards", also known as the duckbill dinosaurs) had hundreds of self-sharpening teeth in rows lining their jaws – about 960 teeth in all!

- Some dinosaurs, such as *Velociraptor*, were considered to be quite fast, while others like *Ankylosaurus* were probably slow and lumbering.

- Unlike modern reptiles such as lizards and crocodiles that walk with sprawling legs, all dinosaurs walked erect with their legs under their bodies for support, some on two legs, others on four.

- Some dinosaurs also had grasping hands. These dinosaurs, unlike other reptiles, would have been able to grasp and hold things, such as their prey.

- Special skeletal features found on dinosaurs include unique skull openings, hip structures that permitted them to walk erect, and relatively straight femurs (similar to modern mammals).

- No one truly knows what dinosaurs looked like, how they were colored, or how they died. Scientists use body fossils, fossil prints (a type of fossil) and the habits of similar modern animals to create theories.

**Fact or Fiction? Dinosaurs could swim and/or fly. Fiction: All dinosaurs lived on land and none could fly (unless you count their descendants - birds). Some dinosaurs could swim, but none were aquatic creatures that could live in the water. The pterosaurs (flying) and the ichthyosaurs, plesiosaurs, and mosasaurs (swimming) were reptiles that lived at the same time as dinosaurs but were not dinosaurs.**

- There are many theories on how dinosaurs became extinct. Three of the most popular are:
  a. Volcanic eruptions caused climate change.
  b. A continental shift caused the weather to change faster than dinosaurs could adapt.
  c. A meteorite strike on earth produced huge clouds of debris, blocking the rays of the sun resulting in a colder climate; therefore killing off all of the plants and animals that dinosaurs used as prey. Scientists have found evidence in rock of a meteorite impact. They have also found the probable crater.

Any or none of these explanations could have led to the mass extinction that occurred at the end of the Cretaceous Period, about 65mya, which killed more than 50% of all life on earth at that time.

One popular theory, that dinosaurs became extinct because mammals ate their eggs, is not very likely. Mammals evolved about the same time as dinosaurs, around 230 mya, and so were around throughout the time of dinosaurs. While some of these small, shrew-like
mammals certainly ate eggs, their size and number did not seem to affect the dinosaur population.

**Fun Dino Fact: Most scientists believe that dinosaur descendants live on today as birds!**

**The Advancement of Dinosaurs**

- Dinosaurs evolved from other reptiles during the early Triassic Period, over 230 million years ago.

- The largest ever known mass extinction, the Permian Extinction, had occurred. It’s been estimated that 90% of species alive at the time became extinct. Dinosaurs began to evolve soon after.

- Mammals also evolved during this time.

- **Archosaurs** (“ruling lizards”) developed over 250 million years ago, during the late Permian Period and dominated the earth during the Mesozoic Era.

- **Thecodonts** (crocodile-like archosaurs) may have been the ancestors of dinosaurs, birds, pterosaurs and crocodilians.

- Archosaurs are **diapsids**. **Diapsids** are characterized by having 2 holes in the skull behind the eye.

**The Earliest Dinosaurs**

- The oldest known dinosaur fossils date from the Triassic Period, about 230 million years ago.

- These fossils were found in Argentina in South America.

- The dinosaurs of the Triassic Period tended to be small and lightly built.

- They were bipedal (moved around on two feet) and were either carnivores or omnivores.

- Most were 10 to 15 feet long and may have been very agile and fast.
The Anatomy of a Dinosaur

- Dinosaurs walked with an erect stance.
- Unlike other reptiles, whose legs sprawl out from the sides of their bodies, a dinosaur’s legs were directly under its body.
- The earliest dinosaurs were bipedal.
- Some dinosaurs later became quadruped, with most having longer rear legs than front legs.

**Fact or Fiction?** All dinosaurs dragged their tails on the ground, like modern lizards. **Fiction:** some dinosaurs probably did, but most dinosaurs had stiffened tails that they held off the ground. Dinosaur tracks rarely include tail marks. The tail was probably elevated and held off the ground, acting as a counterbalance. Tails may have been used as a defensive weapon as well.

Dinosaur Legs: Upright Position

Other Reptile Legs: Sprawling Legs

Courtesy of Zoom Dinosaurs
Different Types of Dinosaurs

The following drawing is of a typical large sauropod, a four legged, slow moving herbivore.

Long neck for eating leaves or needles off of trees

Big gut to digest lots of plant material

Tiny brain and head

Four columnar legs

Tail for counterbalancing the long neck

Courtesy of The University of Queensland, 2003

Fun Dino Fact: Sauropod means “lizard feet” because they had five toes like lizards.

The following drawing is of a theropod, a fast, bipedal carnivore.

Tail for counterbalancing head and neck

Big sharp teeth in scissor-like jaws

Short arms and claws

Long back legs

Copyright © 1996 Christopher Sicks and Jeff Poling
Lizard Hipped or Bird Hipped

There were many different types of dinosaurs. New dinosaurs are being discovered frequently and as a result the number of species is constantly changing. Scientists generally categorize dinosaurs into two groups based on the structure of their hip bones: ornithischians or “bird-hipped dinosaurs” and saurischians or “lizard-hipped dinosaurs”

Fun Dino Fact: Despite their names, birds did not evolve from the ornithischians and lizards did not evolve from the saurischians. Current evidence has shown that birds evolved from lizard-hipped dinosaurs. Lizards are not related to dinosaurs at all.

Saurischians:
- Includes two main groups of dinosaurs: theropods and sauropods.
- Research tells us that most theropods were carnivorous and walked on two legs.
- Some theropods were as small as a chicken (Compsognathus) while others could be as large as an elephant (Tyrannosaurus).
- Sauropods were large dinosaurs that walked on four legs, had long necks, small heads and long tails.
  - Apatosaurus and Brachiosaurus are good examples of sauropods.
- Sauropods were the largest known dinosaurs, and some could weigh more than ten elephants.
  - Prosauropods were early relatives of sauropods, but were smaller with shorter necks and tails.

Ornithischians:
- Ornithischians were very diverse and included many familiar dinosaurs.
- Scientists believe they were mainly herbivores, although some may have been omnivores.
- Their bodies were adapted to help process plant material.
- Hornly beaks helped them crop stems and leaves.
- Rows of teeth with expanded, overlapping crowns allowed them to grind the leaves and stems they ate.
• A group of ornithischians called **thyreophorans** were known as armored dinosaurs, including *Stegosaurus* and *Ankylosaurus*.

• *Stegosaurus* had two rows of plates extending down the back and a set of pointed spikes on its tail.

• Ankylosaurs were almost completely covered in bony elements called **scutes**.

• The scutes gave the animals an appearance similar to that of a giant armadillo.

• *Triceratops* belonged to another group of ornithischians called **ceratopsians**.

• *Ornithopods* were “bird-footed” ornithischians and it is believed that they alternated between walking on two and four legs. Iguanodonts and hadrosaurs are included in this group.

Images courtesy of www.ucmp.berkley.edu
Dinosaur Egg Facts

- Dinosaurs laid eggs like many modern animals, such as birds and reptiles.
- Dinosaur eggs were hard shelled.
- Over 200 dinosaur egg sites have been found all over the world and on every continent, except Australia and possibly Antarctica.
- First identified in the 1920s, eggs have been found in such places as Mongolia, China, France, India, the U.S. (Montana and Utah) and Canada.
- Only recently have fossilized dinosaur embryos and hatchlings been discovered.
- Some dinosaurs laid their eggs in nests. Dinosaur eggs could be laid in different patterns, including spiral, concentric circles, irregular clusters, arcs, parallel rows and double rows.

Fact or fiction? Giant dinosaurs laid giant eggs. Fiction: Dinosaurs may have grown into giants, but their eggs are relatively small. The largest dinosaur eggs were a little smaller than a basketball, but most were much smaller.

- The largest dinosaur egg found to date belonged to the *Hypselosaurus*. This egg was 1 foot long and 10 inches wide.
- Eggs must be permeable (allow for an exchange of gases), so oxygen can enter the egg and carbon dioxide can exit. This is necessary for the developing embryo to survive. If an egg gets too large, the shell would be too thick to allow for this exchange of gases and the developing dinosaur embryo would suffocate.
- An eggshell may have as many as 17,000 tiny pores over its surface that allows oxygen in and carbon dioxide out.

Fun Fact: The largest egg today belongs to the ostrich.

- Paleontologists believe some dinosaurs, such as theropods, may have been altricial, (meaning an animal that needs intense parental care during incubation and for a period of time after hatching).
- Others, such as sauropods, may have been precocial (meaning the animal can take care of itself immediately after hatching).
- There is evidence that Maiasaura babies could not leave the nest and had to be fed by their parents.
• Tracks of sauropod herds show the younger ones traveling in the center of the herd apparently protected by the surrounding adults.

Dinosaur egg nest

Courtesy of Arizona Museum of Natural History

Oviraptor Nest

Unknown theropod nest

Courtesy of The Black Hills Institute

Troodon Therizinosaurus Camarasaurus

Image courtesy of Arizona Museum of Natural History
How Dinosaurs Are Named

- There are usually three major ways dinosaurs are named. By physical features, such as *Triceratops* (three horned face); by who found it, *Zuniceratops christopheri* (after Christopher Wolfe, the little boy who discovered the fossils); or by where it was found, *Sonorasaurus* (found in the Sonoran Desert). Actually the *Zuniceratops christopheri* meets all three!

- If a dinosaur is named after a physical feature, it is given a generic name, usually with a Greek or Latin meaning.

- The word dinosaur is made up of two Greek words, deinos (dino) meaning terrible, and sauros (saur) meaning lizard. The word dinosaur therefore means “terrible lizard.”

**Some dinosaurs named for the place they were discovered are:**

- *Albertosaurus* – Alberta, Canada
- *Bactrosaurus* – Bactria, Mongolia
- *Edmontosaurus* – Edmonton, Alberta, Canada
- *Nemegtosaurus* – Nemegt, Mongolia
- *Zigongosaurus* – Zigong, China

**Some dinosaurs named for people are:**

*Diplodocus carnegii* – for Andrew Carnegie (1835-1919), who financed the expedition to discover a dinosaur for the Carnegie Museum in Pittsburgh, Pennsylvania.

*Hadrosaurus foulkii* – for William Foulke (19th century paleontologist) who excavated the specimen.

**Some dinosaurs named in a way that helps to describe them are:**

- *Arrhinoceratops* – no nose horned face
- *Corythosaurus* – Corinthian helmet reptile
  - *Iguanodon* – iguana tooth
  - *Lycorhinus* – wolf snout
- *Maiasaura* – good mother reptile
- *Procompsognathus* – before pretty jaw
  - *Stegosaurus* – roofed reptile
- *Tyrannosaurus rex* – tyrant lizard king
- *Triceratops* – three horned face
Mesozoic Era

Climate
- The climate of the Mesozoic Era was generally warmer and more tropical than what we experience on Earth today.
- The seasons were very mild.
- There was no polar ice.
- Sea level was higher.
- Greenhouse conditions existed and there could have been higher concentrations of carbon dioxide in the atmosphere.
- Polar regions had seasonal climates with windswept forests during the winter and cool damp rainforests during the summer.

Geography
- For most of the time that dinosaurs lived, a great northern continent, Laurasia, and a great southern continent, Gondwana, existed and at times these two were connected into a super continent called Pangea.
- Pangea altered global climate and ocean circulation.
- Fewer types of dinosaurs lived during the Triassic Period, yet each group had the largest geographic distribution of the Mesozoic Era.
- As the Mesozoic Era progressed the continents began to drift away from each other (Plate Tectonics), eventually keeping the dinosaurs from traveling between continents.
- At the beginning of the Jurassic Period, most of the continents were still joined together, until the Atlantic Ocean began to form and the Americas started to separate from Africa.
- During this same time, large parts of Arizona, Colorado and Utah were desert.
- At different times, shallow seas covered low-lying landmasses, including much of present day Arizona.
- A shallow seaway separated east and west North America during the late Cretaceous Period.

Soundscape
- The sounds of today’s rain forests, thunder, falling rain and the feel and smell of the wet ground may have been very similar to the greenhouse world some dinosaurs that lived in the warmer climates of the Jurassic and Cretaceous Periods would have experienced.
- Those that lived in the polar regions would have heard and experienced a colder, more windswept world.
Fossils

- Fossils are the remains or evidence of ancient life older than 10,000 years preserved in rock or some other material, such as tar or permafrost.

- Studying fossils is the best way for scientists to learn about dinosaurs.

- Plants, animals, and other organisms from past geological ages are represented in the fossil record.

- Paleontologists believe that only a small percentage of dinosaurs and other creatures were fossilized.

- There are two main types of fossils, body fossils and trace fossils. Body fossils are the direct physical remains of organisms, such as teeth, bones, claws, shells, wood, seeds, and leaves. Trace fossils are the indirect evidence of ancient activity (behavior), including tracks, trails, burrows, borings, footprints, eggs and egg nests, coprolite, gizzard stones (gastroliths), and imprints of skin and plants.

- Usually only the hard parts of the body can be fossilized. The softer tissues usually decompose before they can be fossilized.

- The teeth, bones, claws and shells usually last longer, especially if they are buried quickly in mud, sand or silt. This protects these parts from weather damage, rotting and scavengers.

- An “index fossil” can identify and date the strata in which it is found, especially if it is commonly found over a large portion of the Earth and lived for only a short time range.

Fun Fossil Fact: Fossils have been found on every continent, including Antarctica!

- Fossils have the same shape as the original object, but their chemical make-up is altered, reflecting the mineral that have replaced the organic material. Sometimes some of the major bone constituent remains.

- Because fossils are rocks, they usually take on the color of their geological chemical composition, rather than the color of original matter.

- Fossil imprints of skin and other soft body parts have been discovered.

- Fossils should not be confused with artifacts, which are objects that were made by humans.
Fact or Fiction? Scientists can tell what color dinosaurs were by looking at their fossils. Fiction: The soft tissues of the body usually decompose long before fossilization occurs. Fossil dinosaur skin would still be the color of the rock it has become, although sometime the pattern of the skin is preserved. There is no way to tell the color of the skin from the fossils. And since no one has ever seen a real live dinosaur, scientists can only hypothesize about the color of their skin.

- Many of the fossils seen in museums are cast replicas of the original fossils.

Examples of Trace Fossils

Sauropod coprolite
Morrison Formation, Eastern Utah
www.hoopermuseum.org

Parallel teeth marks
(on fossil bone)
Courtesy Mesalands Community College

Hadrosaur footprint (cast)
Image courtesy of Arizona Museum of Natural History

Dinosaur eggs
Courtesy of the Arizona Museum of Natural History
Examples of Body Fossils

Petrified wood
www.unmuseum.org

Fish
Wikipedia.org

Mosasaur skull
2004, Michael Everhart

Brachiopod
www.uscmp.berkley.edu

Sauropod femur
Images courtesy of Arizona Museum of Natural History
DINOSAUR QUESTIONS AND ANSWERS

Q: Did dinosaurs and people live at the same time?
A: NO! After the extinction of the dinosaurs, about 65 million years passed before humans appeared. Small shrew-sized to cat-sized mammals were alive during the time of the dinosaurs.

Q: Where did dinosaurs live?
A: Evidence now shows that dinosaurs lived on all of the continents.

Q: Did some dinosaurs live in water?
A: No. Although fossil trackways show dinosaurs wading into water and perhaps able to swim, no dinosaur was adapted to a permanent aquatic life. All of them lived on dry land. Marine (ocean) reptiles and the flying Pterosaurs were not dinosaurs.

Q: How many types of dinosaurs are known?
A: Approximately 700 species of dinosaurs have been named; however, only about half of these are based on reasonably complete specimens that can be shown to be unique and separate species.

Q: Were dinosaurs warm blooded?
A: It may be that some dinosaurs were warm blooded; however, it is hard to find evidence that unquestionably shows what dinosaur metabolisms were like.

Q: How long did dinosaurs live?
A: An animal's life span depends partly on their body size and partly on their metabolism. A dinosaur lifespan probably varied in length from tens of years to hundreds of years.

Q: Did dinosaurs communicate?
A: Dinosaurs probably communicated both vocally and visually. The chambered headcrests on some dinosaurs such as Corythosaurus and Parasaurolophus might have been used to amplify grunts and bellows. An angry Triceratops bull shaking his head at you, even silently, would have made himself very clearly understood!

Q: Why did some dinosaurs grow to be so big?
A: Paleontologists don’t know for certain, but perhaps a large body size protected them from most predators, helped to regulate internal body temperature, or let them reach new sources of food (some probably browsed treetops, as giraffes do today).

Q: Were dinosaurs slow moving creatures because they had to drag their long tails?
A: Dinosaur fossil tracks rarely include tail marks. The tail was probably elevated and carried off the ground, acting as a counterbalance. Tails may have been used as a defensive weapon as well.
Q: What color were dinosaurs?
A: Direct fossil evidence for dinosaur skin color is unknown. Paleontologists think that some dinosaurs most likely had protective coloration, such as pale undersides to reduce shadows, irregular color patterns (camouflage) to make them less visible in vegetation, and so on. Those dinosaurs that had enough armor, such as the stegosaurs and ceratopsians, may not have needed protective coloration but may have been brightly colored as a warning to predators or as a display for finding a mate. Perhaps dinosaurs were as brightly colored as modern lizards, snakes, or birds.

Q: Where did dinosaurs social animals?
A: Some dinosaurs probably were social creatures. Recently discovered evidence indicates some species traveled together and some may even have migrated (because dinosaur fossils have been found above the Arctic Circle, where food supplies would have been seasonal). Grouped hadrosaur nest sites have been found with badly crushed eggshells and skeletons of baby dinosaurs (with slightly worn teeth) still in the nests, suggesting that some babies stayed in their nests after hatching and were probably fed by parents.

Q: Did dinosaurs hunt in packs?
A: At this point there is no evidence to support this.

Q: Were dinosaurs able to migrate long distances?
A: Some probably did. Great numbers of trackways indicate that herds of Maiasaurus (duckbills) and Ceratopsians (horned dinosaurs) may have migrated between Alaska and the western United States. Today’s great migrators include the wildebeest of Africa and the caribou of Alaska.

Q: How did the T. rex get his name?
A: \textit{Tyrannosaurus rex} means tyrant lizard king and when the first fossils were found it was the largest meat-eating dinosaur found.

Q: Which dinosaur had the largest brain in relation to its body? The smallest?
A: \textit{Troodon}, a rare dinosaur of the Cretaceous period had the largest brain in relation to its body. The \textit{Stegosaurus}, with a brain the size of a walnut, had the smallest brain, relative to its size, of any dinosaur.

Q: Can dinosaurs be considered the most successful animals of all times?
A: In the context of being dominant or higher up on the food chain, as are today’s mammals, the dinosaurs’ dominance of the earth spanned 135 million years. Mammals, on the other hand, have been dominant for only 65 million years. Of course, other creatures, such as insects, spiders, mollusks and sharks, were around before the dinosaurs, were around during the age of the dinosaurs, and are still (or their descendants) around today.
Q: Are birds descended from dinosaurs?
A: This is a very controversial area of science. More fossil evidence is necessary to answer this question. The three current predominant theories of bird ancestry are that birds evolved from (1) a crocodile ancestor, (2) a thecodont (pre-dinosaur reptile), or (3) small dinosaurs.

Q: What is the difference between a paleontologist and an archaeologist?
A: While both are scientists, a paleontologist studies fossils and prehistoric life while an archaeologist studies artifacts and past human cultures.

Q: What is a mass extinction?
A: A mass extinction is a rapid event in which many species die out over a geologically short period of time, usually between 10,000 to 100,000 years. During a mass extinction, the organisms that become extinct represent a significant portion of life on Earth at that time.

Q: What causes a mass extinction?
A: Some of the possible causes of the different mass extinction include global warming or cooling, reductions in habitat due to dropping sea levels, reductions in habitat caused by human activity, volcanic eruptions or meteorite impacts causing climate change, changes in ocean chemistry or diseases.

Q: How many mass extinctions have there been?
A: There have been at least six mass extinctions; the earliest was at the end of the Ordovician Period, around 443 million years ago. The last mass extinction occurred at the end of the Pleistocene Epoch, about 12,000 to 10,000 years ago.
The Dinosaurs of the Arizona Museum of Natural History

**Pentaceratops**

- “Five horned faced dinosaur” was a plant-eater that lived during the late Cretaceous between 90 and 65 million years ago.
- Paleontologists think *Pentaceratops* may have been 7 meters/25 feet long and weighed up to 5 tons.
- It had a bony frill, five horns on its face (two on the brow bone, one on the snout and two on the cheeks) that it may have used for display and protection.
- *Pentaceratops* has been found (so far) only in the southwest, along the New Mexico border, formerly the western shore of a seaway that ran from the Gulf of Mexico to the Arctic Ocean.
- Ceratopsians represent one of the most common types of dinosaurs, one of the last to go extinct and one of the most easily recognized and identified by small children. The *Pentaceratops* was the logo for the Mesa Southwest Museum.
Camarasaurus

- The name means “chambered lizard,” and it lived in North America about 155 to 145 million years ago, during the Jurassic Period. Its bones were filled with chambers of air which helped reduce the animal’s weight.
- Known as the “Jurassic Cow,” this long-neck member of the sauropod family, can be seen in museums around the world.
- A *Camarasaurus* could be up to 65 feet long and was one of the smaller sauropods.
- It was an herbivore, and because of its 48 spoon-like teeth, was most likely a browser who ate ferns, cycads, and pine needles. It probably swallowed its food whole or partially chewed and used stones (gastroliths) in its stomach to help break up its food.
- Its skull was square with a blunt snout. More skulls of this dinosaur are known than all other skulls combined and we have found every bone of this dinosaur’s body.
- A unique feature of the *Camarasaurus* was that all four of its legs were the same length, unusual for most species of dinosaurs.

www.kidsdinos.com

Image courtesy of Arizona Museum of Natural History
Zuniceratops christopheri

- The name means “Zuni horned face” (after the Zuni tribe of North American Indians) was found in 1996 by 8 year old Christopher Wolfe. Christopher is the son of Douglas Wolfe, a paleontologist affiliated with the museum.
- This frilled plant eater lived in the late Cretaceous Period, around 90 million years ago in what is now New Mexico, and is the earliest known ceratopsian to have brow horns. This was about ten million years before the more familiar Triceratops.
- It is the oldest known ceratopsian from North America and represents an evolutionary transition between earlier ceratopsians such as the Asian Protoceratops and the later, larger North American ceratopsians that had very large horns and frills. Zuniceratops had a beak-like snout with a small horn and teeth that could slice up plant food.
- It was 10 to 12 feet long, about 3 feet high at the hips and perhaps weighed up to 400 pounds.
**Stegosaurus**

- Meaning “covered” or “roofed lizard,” it was an herbivore that lived in the late Jurassic Period and had largely disappeared by the Cretaceous Period.
- A *Stegosaurus* was 26 to 30 feet long, 9 feet tall, and weighed about 6,800 pounds. It had a very small head with a long, pointed skull and a tiny brain weighing 2.5 to 2.9 ounces, or about the size of a walnut.
- It had a toothless beak, with small back teeth and may have eaten ferns, small club mosses, cycads, horsetails, and bushy conifers.
- It was a quadruped (walked on four legs), but its back legs were twice as long as its front legs.
- It is characterized mainly by the distinctive plates along its spine and the spikes on its flexible tail, thought to be defensive structures. The tail spikes were certainly defensive, but new evidence points to a dense network of blood vessels beneath the skin covering the bony plates, a feature not consistent with a structure likely to suffer damage during an attack by a carnivore. The exact use is not known, but it could have been used to regulate body heat or as a mating display.
- The tail spikes could be up to 4 feet in length and the number of spikes on the tail varied according to the species.
- Some species also had armor-like scutes (bony plates) on the skin of their neck, hip, and perhaps on their sides for added protection.
**Tyrannosaurus rex**

- The name means “king of the tyrant lizard” in Greek and Latin. *T. rex* was one of the last and the best known of the theropod dinosaurs. (Although birds are theropods.)
- *T. rex* lived in North America during the Late Cretaceous, about 67 to 65 million years ago.
- At over 40 feet in length, 18 feet tall and weighing up to 8 tons, the *T. rex* has long been considered to be the largest terrestrial carnivore to have ever lived. Lately however, there have been two new contenders for that title, the *Giganotosaurus* of South America and the *Carcharodontosaurus* of North Africa.
- *T. rex* had a large head with an extra joint in the lower jaw to allow it to open its mouth very widely to bite large prey.
- Its jaws contained more than 50 curved blade-like teeth. Each 7” to 8” serrated tooth curved backwards to prevent struggling prey from escaping.
- There is some debate among scientists as to whether a *T. rex* used its huge jaws and very thick yet razor sharp teeth primarily to kill their prey or if they may have been scavengers, feasting on the bodies of other dinosaurs that had died from other causes such as disease, injury or old age.

Images courtesy of Arizona Museum of Natural History
**Tyrannosaurus bataar**

- *T. bataar*, whose name means “alarming hero reptile,” roamed Mongolia during the Late Cretaceous and was a very close relative of the North American *T. rex*.
- The specimen in Dinosaur Hall was a juvenile, and when fully grown it may have been up to 40 feet long and weighed up to 6 tons.
- It was older than the *T. rex*, suggesting the genus originated in Asia and migrated to North America via the land bridge that joined the continents during the Cretaceous Period.
- It was a carnivore, and likely ate anything it came across. Because of its bulkiness it was possibly a scavenger, although the debate goes on as to whether the tyrannosaurids were active predators or scavengers.
- The first rather nondescript fossils of a tyrannosaurid were found in the Gobi Desert by the Sino-Swedish Paleontology Expeditions between 1927 and 1931.
- It wasn’t until after World War II that several tyrannosaurid specimens were found in the Gobi Desert, including several nearly complete skulls and skeletons.
- There are a few slight differences between the *T. bataar* and the *T. rex*. The most notable differences are its smaller forearms and a relatively longer skull in the *T.bataar*.
- No *T. bataar* specimens have been found outside of Asia.

![Image courtesy of Arizona Museum of Natural History](image_url)
**Triceratops**

- *Triceratops* means “three horned face.” It is the best known of the ceratopsians.
- *Triceratops* was also the largest and heaviest of this group, weighing between 5 to 7 tons. It was up to 25 feet long and stood 9.5 feet high.
- *Triceratops* lived in western North America during the last few million years of the Late Cretaceous ending 65 million years ago. It was one of the last of the horned-faced dinosaurs to develop and one of the last of all dinosaurs to become extinct.
- *Triceratops* had a smooth, solid frill, a short, thick nose horn and two enormous 40 inch forward-curved brow horns.
- Heavily built with four short sturdy legs, it could have charged like a tank when threatened by the large carnivores of its day, such as a *T. rex*.
- Its frill, the back edge of which was lined with a zig-zag of knobs, was likely used for both display as well as defensive purposes. It also served as protection for the brain and as a place of attachment for the powerful jaw muscles.
- An herbivore, *Triceratops* had a parrot-like beak and scissor-like teeth in its cheek. Ceratopsians, unlike most other dinosaurs, could chew well, the slicing edges of the teeth easily cutting through the tough fibrous plants that made up its diet. The teeth continued to grow, providing a continuous self-sharpening edge.
- *Triceratops* may have traveled in herds that roamed western North America. Many have been found in New Mexico and there is evidence of finds in Arizona as well.
Hadrosaurus

- *Hadrosaurus* means “bulky lizard.” It was the first nearly whole dinosaur found in North America. Originally found in New Jersey, its fossils have also been found in Montana and Alberta, Canada.
- A dinosaur of the Late Cretaceous, it lived between 84 and 71 million years ago.
- The top of the skull has not been found yet, but it is considered to be a Hadrosaurine (no skull crest) because of its body structure. The *Hadrosaurus* had a bulky body, stiff tail, and four legs. Its rear legs were longer than its front legs.
- The *Hadrosaurus* was between 27 and 32 feet long, could be 10 feet tall at the hips, and weighed up to 3 tons.
- An herbivore, it had a wide, flat toothless bill, and a powerful jaw with hundreds of cheek teeth.
- It is a member of the Hadrosaurid family, the duck-billed dinosaurs that evolved from the Iguanodontids. They were largest of the ornithopods, the bird-hipped dinosaurs. *Maiasaura* and *Edmontosaurus* were also members of the Hadrosaurid group of dinosaurs.

![Hadrosaur footprint at entrance to Dinosaur Hall](image1)

**Courtesy of paleodirect.com**

![Image courtesy of Arizona Museum of Natural History](image2)

**Image courtesy of Arizona Museum of Natural History**

**Hadrosaur footprint at entrance to Dinosaur Hall**
Psittacosaurus

- Pronounced si-TA-koh-saw-rus, it was a small, very primitive ceratopsian.
- This “parrot-beaked dinosaur” was 2.6 to 6.5 feet in length, stood about 4 feet high and weighed 50 to 175 pounds.
- It was a bipedal egg layer that belonged to the ornithischian or bird-hipped group of dinosaurs. They had small parrot-like heads with a boxy skull that had short horn-like projections on the cheek.
- *Psittacosaurus* looked like a ceratopsian but it lacked frills and horns. Its front legs were shorter than its back legs and it could probably run on two legs to escape predators. They could also use their short front legs to assist in walking. There were four long “fingers” on each front leg that may have been able to grasp.
- *Psittacosaurus* were herbivores with a toothless beak and sharp slicing teeth to cut through tough plant material. They may have used gastroliths (gizzard stones) to further break down the material. As these animals evolved, better teeth with self sharpening edges replaced the gastroliths.
- Alive in the Early to Mid Cretaceous, between 120 and 90 million years ago, *Psittacosaurus* have been found only in Asia, mainly in Mongolia, China and Siberia. Many complete skeletons have been found in Mongolia.
- Based on the growth lines on its bones, paleontologists believe they had a life span of 10 to 11 years.
- *Psittacosaurus* changed very little prior to extinction, having persisted for about 30 million years.
Protoceratops

- Pronounced pro-toe-CER-a-tops, its name means “first horned face.” It lived in the Gobi Desert in Mongolia during the Late Cretaceous, about 86 to 71 million years ago.
- It was a primitive “neoceratopsian” or new ceratopsian, a group that included all later ceratopsians, such as Zuniceratops, Triceratops and Pentaceratops, and had several primitive characteristics such as single rooted teeth and no brow horns.
- Protoceratops had a bulky body, a large head with a parrot-like beak, cheek teeth and a small frill on its head. They were 6 to 8.5 feet long, 3 feet tall at the shoulders, and weighed up to 900 pounds. It was a quadruped, with four short legs and five-toed feet.
- Protoceratops belonged to the ornithischian group of bird-hipped, herbivorous dinosaurs.
- The hatchlings would have all looked pretty much the same, but as they grew older they changed. Some had wider skulls, long frills and prominent nasal horns and were most likely males. Others, probably females, had narrow skulls, short frills, and less prominent nasal horns.
- Numerous fossils have been found, including nesting sites with multiple nests, eggs in nests, juveniles and mature specimens.
Bagaceratops rozhdestvenskyi

- Pronounced bag-a-CER-a-tops rose-DEST-ven-ski-i, meaning Rozhdestvensky’s small horned face, was a small ceratopsian closely related to the Protoceratops that lived during the Late Cretaceous, about 84 to 71 million years ago.
- Found in Mongolia, this dinosaur was about 3 feet long and weighed about 65 pounds. It had a bulky, barrel shaped body with a short tail, a slender frill at the back of the skull, a small horn on the snout and bony cheek projections. A quadruped, it moved about on short stocky legs.
- Bagaceratops was an herbivore with a toothless parrot-like beak, powerful jaws, and sharp cheek teeth for chewing tough plants.
- It laid eggs and there is evidence that it took care of its babies. This specimen is the top of a skull of a hatchling.

Image courtesy of Arizona Museum of Natural History

Pachycephalosaurus

Arizona Museum of Natural History
480.644.2230 AzMNH.org

www.mce.k12tn.net
• Meaning “thick-headed lizard,” the dome-headed, thick-skulled dinosaur lived in the Late Cretaceous Period.

• The function of this skull, which could be up to 10 inches thick, is not fully understood. The skull may have had a defensive purpose, as a way to recognize each other, to butt tree trunks to knock fruit off of trees, or as a mating display. It has long been thought that the males may have butted their heads in a mating ritual, but newer evidence suggests that the skull bones may have been more porous than previously thought and would not be able to stand up to such battering.

• *Pachycephalosaurus* were about 15 feet long. They had short forearms with clawed five fingered hands, long powerful hind legs with three toes on each foot and a long stiff tail. They had large eyes, a tiny brain and may have had a very good sense of smell. These dinosaurs also had bumpy knobs on their snouts and along the rear of their skulls.

• They were most likely herbivores. *Pachycephalosaurs* had small ridged teeth and could not have eaten tough, fibrous plant materials; rather they may have eaten a mixture of shoots, leaves, seeds, and perhaps even small animals.
• One of the earliest known dinosaurs, it was a small meat eating theropod that lived in the Late Triassic Period.
• Discovered in 1881 and named in 1889, *Coelophysis* was a small, lightly built dinosaur that walked on two long legs. About nine feet long, it had light, hollow bones, a long neck and a long pointed head with dozens of small serrated pointed teeth.
• *Coelophysis* possibly lived and hunted in packs, as is suggested by the existence of fossil bone beds containing hundreds of *Coelophysis* fossils found at Ghost Ranch, New Mexico.
• A *Coelophysis* fossil was sent into space on the Shuttle Endeavor in 1998 and it also traveled to the space station MIR.

*Images courtesy of Arizona Museum of Natural History*

*Apatosaurus*

Arizona Museum of Natural History  
480.644.2230  AzMNH.org
• Once known as the *Brontosaurus*, it was a long-necked herding plant eater from the Late Jurassic Period, about 150 million years ago.
• Sometimes called “thunder lizard” because it is thought that the ground shook as it walked, it was about 80 feet long (longer than a tennis court!) and could weigh as much as six elephants.
• *Apatosaurus* had a very heavyset body supported by four pillar-like legs, a long tail, and a long neck supporting a small head with a tiny brain in proportion to its body size.
• A plant eater with small peg-like teeth, an *Apatosaurus* may have eaten a half a ton of vegetation a day.

Image courtesy of Arizona Museum of Natural History

*Dilophosaurus*
Arizona Museum of Natural History
480.644.2230 AzMNH.org
• Discovered on the Navajo Indian Reservation near Tuba City in Northern Arizona in the early 1950s and was named in the 1970s.
• *Dilophosaurus*, whose name, “two-ridged lizard,” was taken from the distinctive pair of bony ridges atop its head, was one of the oldest carnivorous dinosaurs discovered so far and roamed Arizona about 190 million years ago.
• Approximately 20 feet from head to tail, it stood upright and is believed to have used its forearms to grasp its prey.
• This dinosaur is also a movie star, having had a featured role in the original “Jurassic Park.” You may remember *Dilophosaurus* as the nasty little spitting dinosaur who jumped into the jeep of the creepy computer guy fleeing with the dinosaur embryos. There are a few points where fiction won out over truth. First, the real *Dilophosaurus* was a great deal larger than shown in the movie. And there is no reason to believe they had frills. The spitting is based upon an interpretation of a groove in the jawbone, but is very much in question. Just goes to prove you can’t believe everything you see in the movies!
• Trackways purportedly attributed to this dinosaur can be seen near Tuba City.
• It is the new logo of the Arizona Museum of Natural History.
Coelurosaur

- Meaning “hollow tailed reptiles,” applies to the large group of meat eating dinosaurs that includes allosaurs, tyrannosaurs, and oviraptors. The most advanced members are related to birds and may have had feathers.
- This dinosaur is a new species and is therefore unnamed so far. Before receiving a scientific name, a detailed study must be made to determine how it is different from other dinosaurs as well as how it may be related. “Little Tooth” is its unofficial nickname.
- The Zuni Basin Coelurosaur was found in the Cretaceous Period rocks of the Moreno Hill Formation near the Arizona and New Mexico border during expeditions sponsored by the Mesa Southwest Museum. This is the same formation that contained the *Zuniceratops*, as well as fossil turtles, fish, crocodiles and lizards.
- This reconstructed cast of the skeleton is a composite of two partial fossil skeletons found in rocks that were once forested swamps, lakes and streams 90 million years ago.

Image courtesy of Arizona Museum of Natural History

www.bbc.co.uk
**Oviraptor Eggs**

- For decades, these *Oviraptor* eggs were thought to belong to *Protoceratops*. Recent discoveries, especially of a mother *Oviraptor* brooding her eggs have proved that these eggs actually belong to the small theropod.
- Please note that the eggs seem to be “paired off”, an apparent trait of this dinosaur.
- *Oviraptor* lived during the Late Cretaceous Period, about 85 to 75 million years ago. A small and bird-like omnivore, they were about 6 feet long with a flexible neck, long legs, short arms, and a long tail. Lightly built and agile, an *Oviraptor* probably weighed between 55 to 76 pounds. They had a parrot-like head with extremely strong jaws for crushing things.
- The name, meaning “egg thief” is a misnomer, their toothless jaws were not useful for eating eggs, but for crushing very hard food such as clams.

Image courtesy of Arizona Museum of Natural History

Artwork copyright Joe Tucciarone
**Probactrosaurus gobiensis:**

- Name means “before Bactrosaurus” or “before Bactrian reptile.”
- A relative of the hadrosaur, it was an iguanodont who lived in China during the early Cretaceous Period, around 100 million years ago.
- An adult *Probactrosaurus* was between 17 to 20 feet long.
- An herbivore, it had a horny toothless beak with tightly packed cheek teeth suited to a diet of soft plant material. Under the rows of functional teeth there were other rows of unerupted teeth in the jawbone which would gradually replace the functional teeth as they wore out or were broken.
- A *Probactrosaurus* had a narrow snout and an elongated lower jaw.
- It could walk on all four feet but was probably bipedal (walking on two feet) when moving quickly. It had three toes on the back feet.
- *Probactrosaurus* was a possible ancestor of the duck-billed dinosaurs.
**Scutellosaurus**

- The name, which means “little shield lizard,” refers to its lizard-like appearance and the scutes (small bony plates) that covered it.
- This small herbivore was one of the earliest known ornithischians or bird-hipped dinosaurs.
- *Scutellosaurus* lived in the late Jurassic and has been found in Western North America, including Arizona.
- It weighed a little over twenty pounds, could be 48 to 52 inches long and about 18 inches tall at the hips.
- It had a long body, a long tail, and hind legs that were much longer than the front legs. A *Scutellosaurus* was semi-bipedal, meaning it could walk on two legs or on all four legs.
- It was protected by its speed and the hundreds of small bony scutes that covered its body.

![Image of Scutellosaurus](image_url)

*Image courtesy of Arizona Museum of Natural History*
**Dinosaurs of Arizona**

**Triassic**

*Coelophysis*

**Jurassic**

*Apatosaurus*

*Dilophosaurus*

*Segisaurus halli*

*Scutellosaurus*

*plateosaurian sauropodomorph*

**Anomoepus (I)**

**Navahopus falcipollex (I)**

**Otozoum moodii (I)**

**Grallator/Anchisauripus/Eubrontes (I)**

**Trisauripodiscus (I)**

**Cretaceous**

*Sonorasaurus*

*Tyrannosaur (perhaps an Albertosaurus?)*

*Ceratopsian (perhaps a Chasmosaur?)*

*Titanosaur (perhaps an Alamosaurus?)*

*Titanosaur (Shelly)*

*Small Theropod*

*Hadrosaur*

*Nodosaur*

*Acrocanthosaurus?*

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* Plateosaurus were earlier than the big sauropods. Sauropodomorph is the group that includes both the sauropods and the more primitive plateosaurus.

** These are the names given to foot prints, no body fossils of these creatures have been found. The (I) means ichnofossil. An ichnofossil is a trace fossil, a category that includes footprints.
Vocabulary Words

**Carnivore**  A meat eating animal. Carnivores have large sharp teeth and powerful jaws.

**Cast**  A mold made from the original fossils. These casts are often used in museums so the original fossils can be studied and protected.

**Dinosaur**  A large group of reptiles that were the dominant land vertebrates (had a backbone) on Earth from about 231 million years ago to about 65 million years ago.

**Extinct**  To have died out, no longer existing.

**Fossil**  The preserved remains or traces of organisms that lived in the past.

**Herbivore**  A plant eating animal. Many herbivorous dinosaurs had flat grinding or shearing teeth. There were many more plant eating dinosaurs than meat eating.

**Omnivore**  An animal that eats both meat and plants.

**Paleontologist**  A scientist who specializes in paleontology.

**Paleontology**  The study of plant and animal life in past geological times, based on fossil remains, their relationships to existing organisms and environments, and their importance to the Earth’s history.

**Reptile**  A cold blooded vertebrate that uses lungs to breathe, has an external covering of scales and usually lays eggs.
Fantastic Dinosaur Facts

Largest: *Argentinosaurus*, possibly as big as 114 to 147 ft long this dinosaur would have been longer than three buses put together.

Smallest: *Compsognathus*, this dinosaur was only 2 feet long, about the sized of a chicken.

Fastest: *Ornithomimus*, resembling an ostrich, this dinosaur has been estimated to have run at speeds of 40-50 mph.

Biggest Brain: Troodontids, these dinosaurs had the largest brain-to-body ratio of all the dinosaurs. They are believed to have been as intelligent as modern-day birds.

Smallest Brain: *Stegosaurus*, the *Stegosaurus* had a brain the size of a walnut, possibly assisted by a bundle of nerves in its hips.

Earliest: *Eoraptor*, this dinosaur from Argentina was believed to have lived 227,000,000 years ago.

First Discovered: *Iguanodon*, this dinosaur was discovered in England by Mary Ann Mantell in 1822.

Adapted from Factmonster.com
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</table>
Descriptive Words

Small/Short Words
chunky    short
dumpy     skinny
dwarf     slender
lean      slight
light     slim
little   small
low       squat
midget    stout
miniature stubby
pint-sized thin
runty     tiny
scrawny   wee

Sharp/Hard Words
barbed    razor-edged
bony      rigid
cutting   rocklike
dense     serrated
hard      sharp
jagged    solid
knife-like spike
needle-like spiny
pointed   stiff
prickly   thorny

Large/Long Words
big       long
bulky     massive
colossal  mighty
enormous  monstrous
gigantic  muscular
great     outstretched
heavy     stocky
huge      stout
immense   tall
lanky     thick
large     towering
lengthy   tremendous
lofty     wide

dinosaur Words
armor plated    horn beaked
beaked faced    horned
bird footed     plated
bony headed     scaly-skinned
club tailed     shell like
crested         spike tailed
dome shaped     spiny
duckbilled      thick head
frilled         whip like

Other Words
baby         peaceful
fast         plant eater
fierce       plodding
graceful     scary
hatchling    slow
meat eating  swift
old          young
**Pre Visit Activity**

Ask the students to come up with three to five questions about dinosaurs or prehistoric life they hope to have answered during the field trip. Have students bring their questions to the museum.

**Post Visit Activities**

Have the student share at least one of their questions and the answer with the class.

Have the students write a story about their favorite dinosaur. Describe the animal’s life from its birth (hatching), death, and final discovery as a fossil. They could make a book and illustrate it or they could discuss their story with the rest of the class.

**Discussion Questions**

Ask the students what we can learn about a dinosaur’s diet, size and habitat from the size and shape of its teeth.

Discuss with the students the kind of information that is usually NOT preserved in fossils, such as soft tissues, color and behavior. How would scientists know about these?

Discuss why many dinosaurs were so large and others were small. Ask students to formulate ideas as to why. What are some of the advantages and disadvantages of being so large?

Working in groups, list what they, as humans, would need to survive during the Mesozoic Era. What would they eat? Where would they live? How would they protect themselves?

Discuss different extinction theories. Vote on the one the class thinks is the most possible. What are some of the endangered animals that exist today?
Dinosaur Action Poems

Dinosaur Bones
Let’s look for bones,
dig, dig, dig.
Dinosaur Bones,
Big, big, big.

Back to the lab,
zip, zip, zip.
Clean the bones,
chip, chip, chip.

Put them together,
so, so, so.
We built a dinosaur,
Ho, ho, HO!

Pretend
Spread your arms, way out wide
Fly like a Pteranodon*, soar and glide.

Bend to the floor, head down low
Move like a Stegosaurus, long ago.

Reach up tall, try to be
As tall as Apatasaurus, eating a tree.

Use your claws, grumble and growl
Just like Tyrannosaurus, on the prowl.

*Please note, a Pteranodon is NOT a dinosaur, but a flying reptile that lived at the time of the dinosaurs.

Original poems by Nancy Klein.
D - Green  I - Purple  N - Blue
T t
is for triceratops
A Nest of Dinosaur Eggs

Count the dinosaur eggs in each nest. Write the number of eggs on the lines.
Creative Writing Ideas

1. Write a descriptive essay about being a dinosaur living in a particular region. What would the eat dinosaur eat; would it be a meat eater or a plant eater? How big would it be? What would it look like? What kind of plants and other animals/dinosaurs would be there? What would the weather be like? Would it be warm, hot or cool? Would the climate be wet or dry? What other details would you like to add?

2. What would happen if the dinosaurs had never died out? Or if they suddenly made a come back? What would you do if you found a baby hadrosaur on your doorstep one morning? “What if” situations are a fun way for children to use their imagination. This creative writing activity gives them the opportunity to put their imaginings on paper. Have them draw a picture to illustrate their story.

Below are some “what if” suggestions to use or allow them to make up their own.

What if….

- you were shipwrecked on an island of dinosaurs?
- you made the first dinosaur discovery?
- the dinosaurs hadn’t become extinct?
- you were accidentally locked in a dinosaur museum overnight?
- you built a time machine and went back to the Cretaceous Period?
- you drank a potion that turned you into a dinosaur?
- the dinosaurs reappeared?
- you found a baby dinosaur?
- the dinosaurs had never existed? (What type of animal may have been in its place?)
- you found a big egg, kept it warm and a dinosaur hatched from it?
- you could see a dinosaur no one else could see?
QUICK DINO ACTIVITIES

1. How many 2 to 5 letter words can you make using the word DINOSAUR?

2. Name a meat eating dinosaur that might have been larger than the T-rex.

3. Trace your foot. Measure your print from the base of the heel to the top of your longest toe. Next to your print, measure out 3.3 feet (from the base of your heel past your largest toe). This is the length of a T-rex footprint. How much longer is the T-rex footprint than your footprint?

   Fun Dino Fact: Like most dinosaurs, it is believed that the T-rex actually walked on their toes.

4. Name at least 3 dinosaurs that have been found in North America? How about in the Southwest?

5. Play soundscape music (refer to Soundscapes on page 13. Have students move to the music as if they were dinosaurs.

6. List as many words as you can from Tyrannosaurus.

7. Experience the tedious process of removing a perfect fossil from stone by “digging for dinosaur bones” using a toothpick to separate chocolate chips from a cookie without breaking the chip.
Making An Imprint Fossil

Supplies:

<table>
<thead>
<tr>
<th>“Stone” Dough Mix</th>
<th>“Fossils to Imprint”</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ cup of salt</td>
<td>Twigs</td>
</tr>
<tr>
<td>1 cup of flour</td>
<td>Leaves (stiff bay leaves work well)</td>
</tr>
<tr>
<td>½ cup of brewed coffee (cold)</td>
<td>Seashells</td>
</tr>
<tr>
<td>1 cup of used coffee grounds</td>
<td>Chicken bones</td>
</tr>
<tr>
<td>Measuring cups</td>
<td>Plastic dinosaur models for skin</td>
</tr>
<tr>
<td>Mixing spoon</td>
<td>texture or footprints</td>
</tr>
<tr>
<td>Mixing bowls</td>
<td></td>
</tr>
</tbody>
</table>

Procedure:

1. Measure salt, flour, coffee, and coffee grounds. Add each to the bowl and stir together until well mixed.

2. Turn this dough out onto a large sheet of waxed paper and knead until smooth.

3. Break off a piece large enough for the imprint you want to make, roll it into a ball, and use the heel of your hand to flatten it out.

4. Press the object you wish to make a fossil imprint of firmly into the dough. You can use more than one object if you like. Carefully remove the objects to leave the prints behind. Let your fake stone dry overnight and you will have an imitation fossil!

**** You could also use clay, Crayola Model Magic or plaster of paris or any other type of modeling material you wish.

Discussion Point
What you are doing is very much like the way real imprint fossils were created. Millions of years ago plants, bugs, or other animals left impressions in soft mud. This mud eventually dried and became rock.

Much of what we know about ancient, extinct plants and animals comes from such imprints since neither skin or feathers are likely to survive as actual fossils, the way bones do. This is how we know what the texture of dinosaur skin was and why scientists believe some dinosaurs may have had feathers.
DINOSAUR POEM

Write a poem below. Begin each line with a word that begins with the letter on that line.

D
I
N
O
S
A
U
R
DINOSAUR SIMILES

A simile is a comparison using “like” or “as”.

For example: The dinosaur was as big as a house.

Complete the similes below.

1. The dinosaur was as big as a ________________________.
2. The baby dinosaur was as ______ as a ____________.
3. The dinosaur looked like a ________________________.
4. The skin was like ________________________________.
5. The teeth were as sharp as a ______________________.

Now write some of your own.

6. ________________________________.
7. ________________________________.
8. ________________________________.
## DINOSAUR UNSCRAMBLE

<table>
<thead>
<tr>
<th>TXCNIET</th>
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<tbody>
<tr>
<td>SOINUDAR</td>
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<tr>
<td>RENIRCAVO</td>
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<td>SFISOSL</td>
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<td>RUJSASCI</td>
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</table>
# Dinosaur Name Game

What do these dinosaur names mean?

<table>
<thead>
<tr>
<th>Dinosaur Name</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allosaurus</td>
<td></td>
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<tr>
<td>Brachiosaurus</td>
<td></td>
</tr>
<tr>
<td>Coelophysis</td>
<td></td>
</tr>
<tr>
<td>Deinonychus</td>
<td></td>
</tr>
<tr>
<td>Iguanodon</td>
<td></td>
</tr>
<tr>
<td>Pachycephalosaurus</td>
<td></td>
</tr>
<tr>
<td>Stegosaurus</td>
<td></td>
</tr>
<tr>
<td>Triceratops</td>
<td></td>
</tr>
<tr>
<td>Troodon</td>
<td></td>
</tr>
<tr>
<td>Tyrannosaurus rex</td>
<td></td>
</tr>
<tr>
<td>Velociraptor</td>
<td></td>
</tr>
</tbody>
</table>
Dinosaur Name Game Key

*Allosaurus* = “Strange Lizard”

*Brachiosaurus* = “Arm Lizard”

*Coelophysis* = “Hollow Form”

*Deinonychus* = “Terrible Claw”

*Iguanodon* = “Iguana Tooth”

*Pachycephalosaurus* = “Thick Headed Lizard”

*Stegosaurus* = “Roofed Lizard”

*Triceratops* = “Three Horned Head”

*Troodon* = “Wound Tooth”

*Tyrannosaurus rex* = “Tyrant Lizard King”

*Velociraptor* = “Speedy Thief”
Answer Key

A Nest of Dinosaur Eggs

Top Row  left - 4  right - 5
Middle Row left - 6  right - 4
Bottom Row left - 4  right - 6

Dinosaur Sizes Math Activity

Seismosaurus  3 buses
Diplodocus  2 buses
Tyrannosaurus rex  1 bus
Triceratops  2 cars
Stegosaurus  2 cars
Velociraptor  ½ car
Compsognathus  ¼ car
QUICK DINO ACTIVITIES

Answer Sheet

1. **Words may include:** an, and, as, din, dour, in, nod, or, ran, rid, rind, road, roar, rod, round, sand, sin, so, soar, sod, soda, son, sound, sour, sun.

2. Carnivorous dinosaurs that may have been bigger than a *Tyrannosaurus rex* include the *Giganotosaurus* and the *Mapusaurus roseae*, both of which have been found in Argentina.

4. **Dinosaurs found in North America include:** *Ankylosaurus*, *Brachiosaurus*, *Camarasaurus*, *Chasmosaurus*, *Corythosaurus*, *Deinonychus*, *Diplodocus*, *Dromaeosaurus*, *Edmontosaurus*, *Hadrosaurus*, *Hypsilophodon*, *Lambeosaurus*, *Maiasaura*, *Pachycephalosaurus*, *Parasaurolophus*, *Troodon*, *Tyrannosaurus rex*.
   **Dinosaurs found in the Southwest include:** *Alamosaurus*, *Allosaurus*, *Apatosaurus*, *Coelophysis*, *Dilophosaurus*, *Pentaceratops*, *Scutellosaurus*, *Sonorasaurus*, *Stegosaurus*, *Triceratops*, *Utahraptor*, *Zuniceratops*.
   **Please note:** this is only a partial list, there were many more dinosaur fossils found throughout both North America and the Southwest.

6. **Words may include:** a, an, annoy, ant, art, array, as, assort, aunt, aunty, aura, nor, not, nun, nut, onus, or, ran, rat, roan, roast, rot, run, runny, runt, runty, rust, rush, sauna, sort, star, story, stray, tar, ton, toy, tray, tuna, turn, unto, urn, yarn, you, your, yours.
DINOSAUR POEM
(Example)

Write a poem below. Begin each line with a word that begins with the letter on that line.

Dinosaurs are fun,
Interesting and
Not boring at all!
Oh
So come along and learn with us
And you will
Understand!
ROARRRRRR!
DINOSAUR SIMILES
(Examples)

A simile is a comparison using “like” or “as.”

For example: The dinosaur was as big as a house.

Complete the similes below.

1. The dinosaur was as big as a ______ school bus ______.

2. The baby dinosaur was as cute as a ____________.

3. The dinosaur looked like a ____________.

4. The skin was like ________________________.

5. The teeth were as sharp as a ____________.

6. ____________________________________.

7. ____________________________________.

8. ____________________________________.

Now write some of your own.

6. The dinosaur’s tail was as long as a whip ______.

7. The dinosaur was as scary as a hungry lion ______.

8. The dinosaur’s roar was as loud as thunder ______.
# DINOSAUR UNSCRAMBLE KEY

<table>
<thead>
<tr>
<th>UNSCRAMBLED WORD</th>
<th>MEANING</th>
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