

DINOSAURS

ATOM Study Guide

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AT SAN JOSE

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OVERVIEW

Walking With Dinosaurs – The Live Experience is bringing dinosaurs back to life in an once-in-a-lifetime theatrical performance that educates and amazes its audiences. Walking With Dinosaurs – The Live Experience features 15 life-size mechanical dinosaurs roaming the arena floor, while a “palaeontologist” narrates the story of the rise and fall of the dinosaurs. Since the show is totally unprecedented, I would encourage you to watch the sneak preview video at www.dinosaurlive.com or www.hppavilion.com/WWD. You will see that the show is not only awe-inspiring, but extremely educational.

The show is based on *Walking With Dinosaurs* (Tim Haynes, 1999) – a 180-minute six-part BBC television series that recreates the world of the dinosaurs over a period of 155 million years. This will be the family event of the year and arguably the greatest family show to come to HP Pavilion. Walking With Dinosaurs has played to sell-out crowds across the country since July and we expect it to be just as popular in this market.

With this great event, dinosaurs have come back into the forefront of science and culture. Walking With Dinosaurs – The Live Experience offers an in-depth look at these amazing creatures, but there remains many facets of the dinosaurs to be learned. We believe the dinosaurs are an excellent subject of study for a wide range of students and offer this study guide as a tool for educators. The following lessons can be used alone or in conjunction with attending Walking With Dinosaurs – The Live Experience or viewing *Walking With Dinosaurs* – the television series.

Either way, enjoy your journey back in time.

TO TEACHERS

What is a dinosaur?

Do students know what a dinosaur is?

The word dinosaur means 'terrible lizard' in Greek. A dinosaur is a reptile that evolved an upright gait similar to that of mammals – that is, their legs were straight, perpendicular to the ground and supported the weight of the body so that they could walk or run more easily. Other reptiles and modern lizards have a sprawling gait.

Dinosaurs evolved around 230 million years ago and lived in the Mesozoic period – known as the 'age of reptiles'.

There were more than 700 different types of dinosaur.

They are often classified as either meat-eaters (carnivores) like Tyrannosaurus Rex, or plant-eaters (herbivores) like Triceratops.

Dinosaurs all looked different. Some walked on two legs and others walked on four.

Some were very fast like Velociraptor but some were slow and lumbering, like Ankylosaurus.

Some had horns and spikes, or bumpy skin. But no one actually knows what colour or pattern dinosaurs were.

Dinosaurs ruled the Earth for about 160 million years, then suddenly died out around 65 million years ago.

There are several theories about why this happened. The most accepted theory is that a giant asteroid crashed into earth around this time and caused catastrophic changes to the climate. It was probably freezing cold and the dinosaurs could not adapt to the new weather conditions.

There are, however, other theories, and these are looked at in this study guide.

Scientists called palaeontologists study fossils and old bones to find out more about dinosaurs and how they lived. *Walking With Dinosaurs* is based on many of the findings of modern palaeontology, but it also includes many aspects that are controversial and speculative.

Introductory Activities

Walking With Dinosaurs – The Live Experience covers a huge range of time.

It is important to try and have some idea about the extent of this time range, and about the chronology of the period.

Here is a way of building up a timeline to help you do this.

Activity 1 What do you think?

Look at the events in this list. They are not in their correct time sequence. Number them in the order you think they occurred over time. This is not a test, so just work out what order you think things happened in. You can check your answers below.



List these events in the order you think they happened, from 1 (first or oldest) to 12 (last or most recent)

- | | |
|--|---|
| <input type="radio"/> First animal with a backbone | <input type="radio"/> First ants |
| <input type="radio"/> First dinosaurs | <input type="radio"/> First egg-laying reptiles |
| <input type="radio"/> First ferns | <input type="radio"/> First flowering plants |
| <input type="radio"/> First grasses | <input type="radio"/> First humans |
| <input type="radio"/> First mammals | <input type="radio"/> First sharks and fishes |
| <input type="radio"/> First turtles | <input type="radio"/> First Tyrannosaurus Rex |
| <input type="radio"/> Extinction of dinosaurs and many other animals | |

Activity 2 Making a timeline

Here is the order in which these events happened.



480 million years ago (20)	First animal with a backbone
400 million years ago (180)	First sharks and fishes
350 million years ago (280)	First ferns
300 million years ago (380)	First egg-laying reptiles
228 million years ago (520)	First dinosaurs
210 million years ago (560)	First turtles and first mammals
120 million years ago (740)	First flowering plants
100 million years ago (780)	First ants
70 million years ago (840)	First Tyrannosaurus Rex
65 million years ago (850)	Extinction of dinosaurs and many other animals
20 million years ago (940)	First grasses
4 million years ago (960)	First humans
(980)	Today

Here is how you can make a class timeline to show this.

- 1 Use a roll of adding machine paper 10 feet long and pin or stick it on a board or wall in your classroom.
- 2 Cut the above table into sections and distribute these among groups.
- 3 Each group copies its event on to a post-it sticker.
- 4 Attach that to the roll in correct position. The number in brackets shows where the event should be placed on the timeline.

Activity 3 Adding geological periods to your timeline

- 1 Cut this table of time periods into sections and distribute them among groups.
- 2 Write each time period on a different coloured post-it sticker, and add each to the timeline. Groups with the Era, Period and Epoch names also add those in different colours.
- 3 You will be able later to attach your own research findings about dinosaurs (see the activity below) to this timeline.



ERA	PERIOD	EPOCH	MILLION YEARS AGO
CENOZOIC	Quaternary	Recent	0.01
		Pleistocene	1.8
	Tertiary	Pliocene	5
		Miocene	24
		Oligocene	38
		Eocene	54
		Palaeocene	65
MESOZOIC	Cretaceous		141
	Jurassic		210
	Triassic		250
PALAEOZOIC	Permian		290
	Pennsylvanian		320
	Mississippian		360
	Devonian		410
	Silurian		440
	Ordovician		500
	Cambrian		543
PRECAMBRIAN			4,500-540

Activity 4 How the earth has changed over time

The earth is not the same now as it was at the time of the dinosaurs.

Even during the time of the dinosaurs it changed greatly.

The following website gives snapshots of six periods of time.

<http://internet.nhm.ac.uk/jdsml/nature-online/dino-directory/region.dsml?disp=gall&perID=1®ionID=&sort=Genus>

The six illustrations of the earth match these periods – but they are not in the correct chronological order.

- 1 Print and cut the earth illustrations out and paste them with the correct time periods.
- 2 You can then add these to the timeline.

220 million years ago Late Triassic	All land was joined in one continent, Pangaea.	
152 million years ago Late Jurassic	Pangaea was splitting into two, called Laurasia and Gondwanaland.	
149 million years ago Late Jurassic	There were still the two continents, but the sea level was higher.	
127 million years ago Early cretaceous	Splitting into five main areas.	
106 million years ago Early cretaceous	Higher sea levels, and Africa and South America starting to separate.	
65 million years ago Late cretaceous	Australia now separating from Antarctica.	

Activity 5 Dinosaur names

In *Walking With Dinosaurs – The Live Experience* you will hear many dinosaur names – many of which seem strange.

But they do make good sense, if you know how to ‘decode’ them.

Here is a list of Greek and Latin words that are used to create dinosaur names, and their English meaning.

allo	strange	don, dont	tooth	pacro	ridge
anato	duck	drypto	wounding	ped	foot
ankylo	crooked	echino	spiked	plateo	flat
anuro	no tail	elasma	plated	proto	first
apato	deceptive	gnathus	jaw	raptor	robber
baro	heavy	lana	wooly	rex	king
bi	two	lepto	slender	rhino	nose
brachio	arm	macro	large	saur, saurus	lizard
bronto	thunder	maia	good mother	stego	roof
canthus	spiked, spined	mega	huge	stereo	twin
cerat, ceros	horned	micro	small	super	superior
cephalo	head	mimus	mimic	tri	three
compso	pretty	mono	one, single	tyranno	tyrant
cory	helmet	nano	dwarf	ultra	extreme
di	two	nodo	lumpy	urus	tail
dino or deinos	terrible	ops	face	veloci	speedy
diplo	double	ornitho	bird	xeno	strange
docus	beam	pachy	thick	xero	dry

1 Here are the names of seven different dinosaurs. What do they mean? Use the ‘code’ to find out what they mean.

Brachiosaurus	
Ankylosaurus	
Compsognathus	
Stegosaurus	
Triceratops	
Allosaurus	
Pachycephalosaurus	

2 Look at an illustration of each and decide if they are good names.

You can find illustrations of dinosaurs at <http://internet.nhm.ac.uk/jdsml/nature-online/dino-directory/>

As you come across other dinosaur names you can refer back to this list to work out what they were like.

EXPLORING ISSUES AND IDEAS

To the teacher

Walking With Dinosaurs – The Live Experience covers the long history of dinosaurs on earth.

Classes might like to:

- have a group of students introduce and report on one of the periods during which the dinosaurs lived

OR

- select a number of dinosaurs for individuals to research further. The results of research into dinosaurs can be added to the timeline developed in the introductory activities in this study guide.

Researching dinosaurs

Walking With Dinosaurs – The Live Experience shows us many dinosaurs. But it does not tell us all about them. We need to do some more research.

Research one or more of these, using the Dinosaur Research Page that follows as a guide. You can then add your research finding to your class timeline.

1

*Coelophysis
*Plateosaurus
Cynodont
Peteinosaurus
Placerias
Postosuchus

2

*Stegosaurus
*Allosaurus
*Brachiosaurus
Diplodocus
Anurognathus
Ornitholestes

3

Cryptoclidus
Eustreptospondulus
Hybodus
Liopleurodon
Othalmosaurus
Rhamphorynchus

4

*Ornithocheirus
*Utahraptor
Iguanadon
Polacanthus
Tapejara

5

Dwarf allosaur
Koolascuchus
Leaellynasaura
Muttaburrasaurus

6

*Ankylosaurus
*Torosaurus
*Tyrannosaurus Rex
Anatotitan
Quetzalcoatlus

Dinosaur Research Page

1 Name (Greek/Latin and its meaning, and the family or main group of dinosaurs it came from)	Include the image here
2 Appearance (Size, shape, skin, movement, colour, noise made, behaviour)	
3 Environment (Type, how this animal was adapted to it or able to make use of it to its advantage)	
4 Survival (Food sources, skills, protective devices)	
5 Dangers faced (Main predators or problems it faced)	
6 Advantages/Strengths	
7 Disadvantages/Weaknesses	

To find a picture of dinosaurs go to the Dino Directory at <http://internet.nhm.ac.uk/jdsml/nature-online/dino-directory/>

How do we know? Using evidence to come to conclusions

Most of what we know about dinosaurs comes from fossils and bones.

A fossil is the mineralized remains of animals or plants or other traces such as footprints.

Here are some exercises from the American Museum of Natural History that show you how scientists use evidence to come to conclusions about what dinosaurs looked like, and how they behaved.

Activity 1 What do dinosaur teeth tell us about their lives?

You can do this activity at home or in class if you have all the elements needed.

- 1 Look at the teeth on these dinosaurs and complete the following table.

A



B



C



D

<i>Dinosaur</i>	<i>1 Describe its teeth</i>	<i>2 Would it eat meat or plants?</i>	<i>3 Your reasons for deciding this:</i>
A			
B			
C			
D			

For the next part you need:

- A staple remover – to represent one type of teeth
- 2 flat surfaced rocks – to represent another type of teeth
- A cotton ball – to represent meat
- 1 or 2 leaves – to represent plant food
- A hand mirror
- A piece of carrot

2 'Eat' the 'meat' using the first type of teeth, then the second type. Which are the best teeth for this food source? Why?

3 'Eat' the plants using the first type of teeth, then the second type. Which are the best teeth for this food source? Why?

4 Look in a mirror at your own teeth. Do you have sharp teeth, or blunt teeth, or both? What conclusion do you come to about what food humans can eat?

5 In fact humans have three different type of teeth: Incisors, canine and molars. Identify these in your mouth.

6 Now use your teeth to:

- grate or rake off the carrot's outer layer
- slice or bite off a piece of the carrot
- grind up a piece of the carrot.

Which teeth are best for each activity?

What you are seeing is that there are four different activities associated with teeth: chopping, stripping, grinding, ripping.

7 Which two of these would be most useful for meat eaters, and which two for plant eaters?

- 8 Look at the dinosaur skulls below. Look carefully at the teeth.
- Write 'chopper' under the skull of the dinosaur that used its teeth to chop up plants.
 - Write 'stripper' under the skull of the dinosaur that used its teeth to strip leaves off branches.
 - Write 'grinder' under the skull of the dinosaur that used its teeth to grind up plants.
 - Write 'ripper' under the skull of the dinosaur that used its teeth to rip meat off its prey.

Look at the dinosaur skulls below. Look carefully at the teeth.

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- Write *ripper* under the skull of the dinosaur that used its teeth to rip meat off its prey.



- 9 What can fossil teeth tell us about dinosaurs?

http://www.amnh.org/education/resources/rfl.php?set=b&topic_id=5&subtopic_id=80

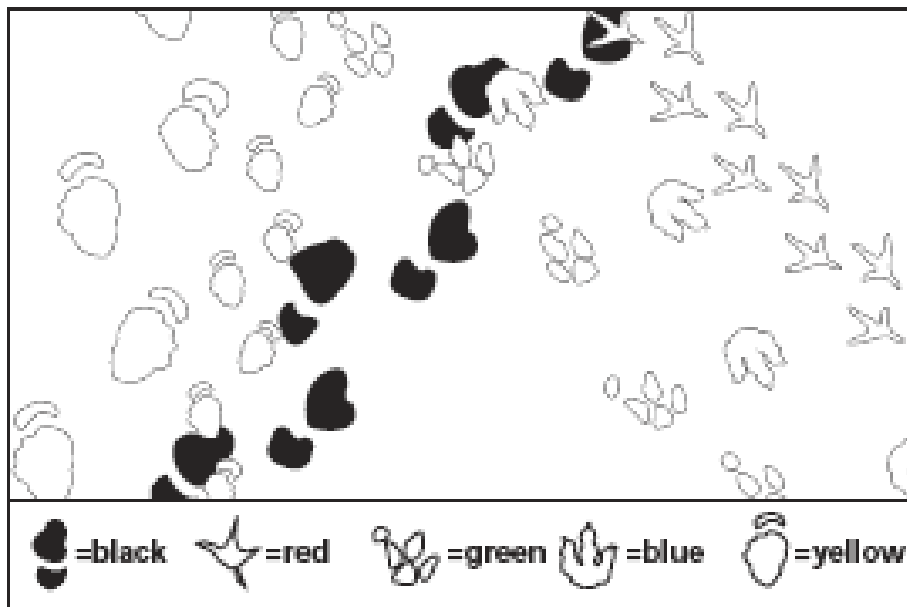
Activity 2 What do fossil dinosaur tracks tell us about their lives?

Palaeontologists often discover dinosaur tracks.

These tracks can help us understand not only which dinosaurs were there, but also what happened.

Here is an exercise from the American Museum of Natural History:

1 Here is an illustration of a set of fossilised dinosaur tracks. Colour in the different tracks in the way suggested.



- 2 How many different kinds of animals were here?
- 3 Did the animal that left the red tracks walk on two or four legs?
- 4 Was it walking or running?
- 5 Did the animal that left the yellow tracks travel alone?
- 6 Which dinosaur walked across the area first?
- 7 How many individual animals were here?
- 8 If these animals were here at the same time, why were they here?

You can find some interactive exercises on fossils at:

<http://www.nmnh.si.edu/paleo/dinosaurs/interactives/dig/main.html>

http://www.amnh.org/education/resources/rfl.php?set=b&topic_id=5&subtopic_id=80