Dinosaurs

Dinosaurs. Everyone has heard about them. Everyone has, at one time or another, read about them or seen them on TV. These large prehistoric beasts have captured the imagination of so many people. But what do we really know about them?

The study of dinosaurs began in the early 1800s. British anatomist Sir Richard Owen was among the first scientists to study them, and in 1842, he named them “dinosaurs” after the Greek words *deinos*, meaning “marvellous” or “terrible”, and *sauros*, meaning “lizard”. At that time, the only known species were **Hylaeosaurus**, **Megalosaurus** and **Iguanodon**. As of today, scientists have described more than 1,300 species of dinosaur in almost 500 genera!

What did Dinosaurs look like?

We know that there were many species of dinosaurs, but we do not know what many of them looked like. Fossilized bones can tell us their size and general shape but not the details of individual appearance. Fortunately, some skin impressions have been discovered, giving scientists more clues about what dinosaurs looked like. Dinosaur skin types ranged from bumpy (like the tread of a bicycle tire) to scaly (similar to a modern-day lizard) to leathery (like the texture of a football). Some scientists believe that several species may have been at least partially covered with feathers.

Unfortunately, fossil skin impressions give no indication of colour. At first, scientists believed that dinosaurs were coloured much like the largest animals living today – like elephants and whales, dinosaurs would have been grey, brown or muted earth tones.

Today, the dinosaur palette boasts a wide range of pigments and a variety of colour combinations. Some scientists believe that if dinosaurs are the ancestors of modern birds, then they too may have worn bright colours. Most agree that species would have been coloured to suite their environment: dinosaurs living in Mongolia's Gobi Desert were likely tan or sandy coloured to blend into the background, and those that lived in the forests probably wore green and brown. Still, dinosaur colouration is pure speculation – no one really knows what colour they were.

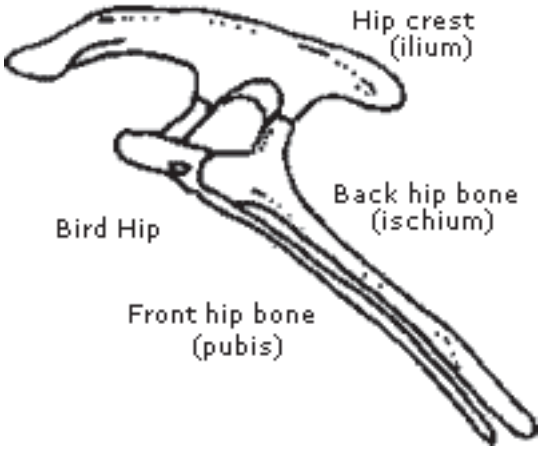
From Ears to Tails

Dinosaurs varied in shape and size. Some grew no bigger than a chicken, while others would dwarf an elephant. Some had bumps on their heads, others had horns. Some had spiked tails and others wore spikes on their backs. But what about ears? Did dinosaurs have ears like ours? Did they point upward like a cat's, or hang down like a hound dog's? We can only guess the shape of dinosaur ears, because external ear tissue is generally soft and fleshy, and does not fossilize. Certainly, dinosaurs could hear. But not all animals have external ear parts. Because some modern relatives of dinosaurs – namely, birds and reptiles – have no external ear parts, it is unlikely that Dinosaurs had them. It is difficult to know – and it's also difficult to imagine T-Rex with elephant ears!

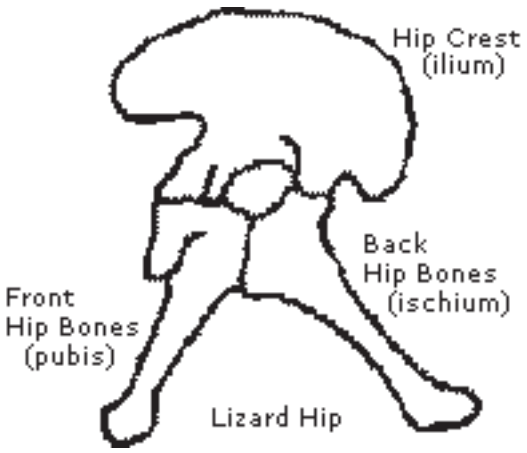
At the other end of the body we have the tail. Dinosaur tails vary in shape and size. Accessories such as spikes and bumps were likely used in fighting or as protection. Others may have grown long tails as a sort of counter balance: dinosaurs with long necks, like Lufengosaurus and Mamenchisaurus, carried so much weight in front of their body that they needed the weight of a long tail to keep their balance. This might also have been true for large meat eaters, like Yangchuanosuarus and T-Rex, whose tail would help balance their large body in its upright posture, especially when charging after prey.

Dinosaur Classification

Sir Richard Owen distinguished dinosaurs from other prehistoric reptiles by their upright rather than sprawling legs and by the presence of three or more vertebrae supporting the pelvis. A dinosaur's legs extend below its body, more like the legs of a mammal than a lizard.



About 300 million years ago, amniotes (vertebrates with shelled eggs) gave rise to three types of animals: turtles, mammal ancestors (technically called synapsids) and true reptiles. The ancestral line of true reptiles branches again into three major groups: lizards, snakes and plesiosaurs in one, archosaurs in another, and ichthyosaurs in the third. Between 250 and 230 million years ago, in the Triassic Period, the archosaurs ("ruling reptiles") divided again into a line of crocodiles and a line that includes dinosaurs and pterosaurs (flying reptiles). Several sidelines branched off the main archosaur lines, all ending in extinction.



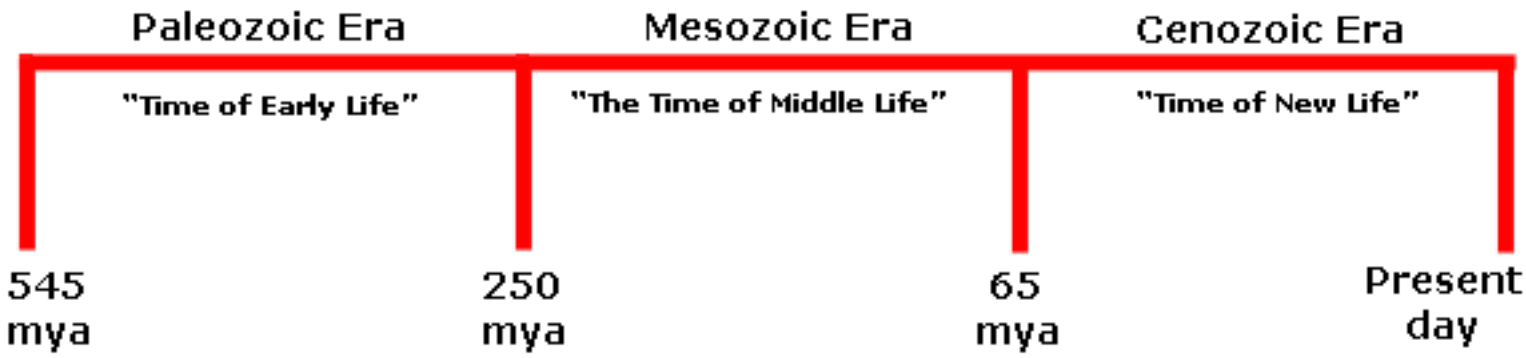
Dinosaurs themselves are classified into two main orders according to differences in hip (pelvic)

structure: Saurischia (lizard-hipped) and Ornithischia (bird-hipped). Within these two groups there are many smaller branches in the dino family tree. All bird-hipped dinosaurs that we know of are plant eaters; some well-known bird-hips are stegosaurs, iguanodons and ceratopsians (e.g., Triceratops). Lizard-hipped dinosaurs include the giant plant eaters, such as Diplodocus and Mamenchisaurus, and meat eaters of all sizes.

It is important to remember that not all big prehistoric beasts were dinosaurs – pterosaurs, plesiosaurs, ichthyosaurs and mosasaurs were all reptiles, not dinosaurs. Some giant lizards and crocodilians also lived at the same time as dinosaurs.

Time

Dinosaurs lived many millions of years ago, long before humans. Many other kinds of animals lived during this same time, including other reptiles, early mammals, insects and

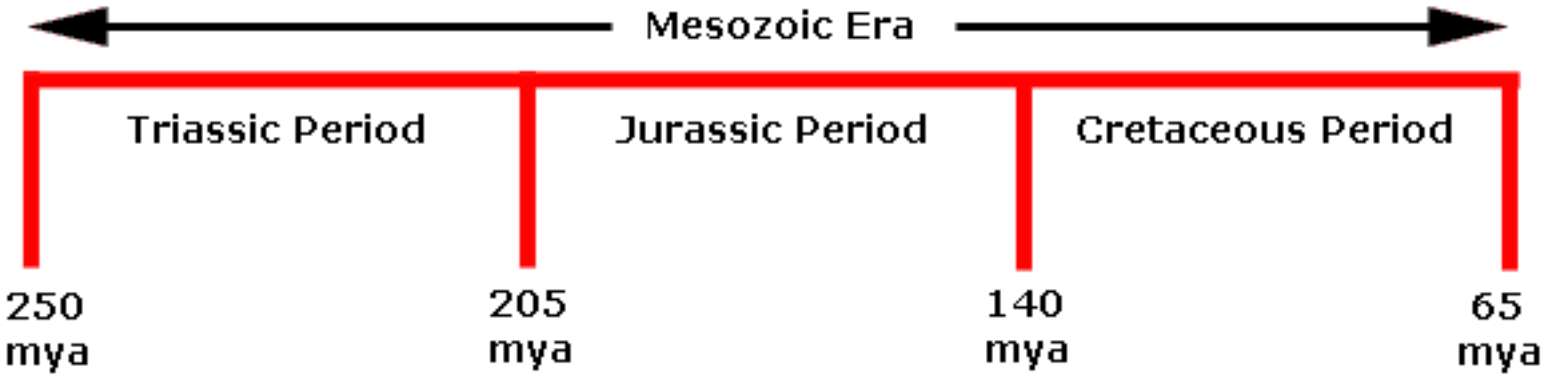


birds. The stretch of time that dinosaurs dominated the Earth is sometimes called the Age of Dinosaurs. Scientists call this time the Mesozoic Era – *Mesozoic* is from the Greek words *meso*, meaning “middle”, and *zoe*, meaning “life”, so Mesozoic Era means “the time of middle life”, from 250 to 65 million years ago (mya). The time just before the Mesozoic is called the Paleozoic Era (“time of early life”), 545 to 250 mya, and the time just after it, up to present day, is the Cenozoic Era (“time of new life”).

But Earth's history stretches back long, long before the Paleozoic Era: 4.6 billion years – that's 4,600 million years. This amount of time is so vast that it is difficult to understand, even when looking at a chart. One way of demonstrating the time of life on Earth is to stand and stretch out one arm forward, pointing the index finger. Consider the length of the arm as the entire age of the Earth, beginning at the shoulder, with today being the tip of the index finger. From the shoulder to just before the first knuckle is the time before the Paleozoic, when life was forming in the oceans and remained mostly algae until, sometime on the back of the hand, primitive marine animals appeared. The Paleozoic Era goes from that spot just before the first knuckle to the second knuckle. During this time, life really started to diversify, starting with corals, trilobytes and the first fishes, and moving on to land, primitive plants, amphibians, insects and the first reptiles. The Mesozoic Era goes all the way from the middle knuckle to the beginning of the fingernail – this is the Age of Dinosaurs. The Cenozoic Era is the fingernail itself, after the extinction of dinosaurs, when mammals and eventually humans came to dominate the Earth. But if you took a nail file and scrapped off just the tip of your finger nail, you would be erasing all of human history!

Back in the Mesozoic Era, the Earth was a different place. When it began, 250 mya, the continents were all bunched up together into one massive supercontinent called Pangaea (Greek for "all earth"). This monstrous land experienced extreme climates and supported a variety of ecosystems. Huge, searing deserts occupied the heart of the continent. Forests and steaming tropical swamps covered the less hostile regions. This environmental crucible cooked up a stew of new plant and animal life, and set the stage for the Age of

Dinosaurs. Primitive conifers, some related to araucarias (monkey puzzle trees and Norfolk Island pines) of today's southern hemisphere, dominated the forests. Ferns, palm-like cycads and their relatives, giant club-mosses and other now-extinct plants thrived under the diffuse canopy. Drought-resistant ferns covered open lands long before the coming of grasses. All around Pangaea was a huge ocean, called Panthalassa ("all sea"). Giant marine reptiles evolved from land-based forms to share the ocean with primitive fishes and many invertebrates.



The Mesozoic Era is divided into three periods: Triassic, Jurassic and Cretaceous. Just before Triassic Period began, 250 mya, widespread extinctions of animals and plants brought the Permian Period and Paleozoic Era to an end. Scientists estimate that 95% of all species died out. No one is sure why these extinctions occurred. They might have been caused by extreme changes in climate, ocean temperature or sea level. Whatever the reason, the vacancies they left were filled by a variety of new creatures – especially reptiles and, eventually, dinosaurs. Some of the other animals that evolved after the Permian extinctions are turtles, frogs, salamanders and lizards.

Dinosaurs were not the first of the large reptiles to appear in the Triassic Period. Lotosaurus was a non-dinosaur reptile that went extinct in the middle Triassic. Ancient mammal relatives, such as Lystrosaurus, predominated the land at times. Dinosaurs did not arrive until the latter part of the Triassic Period.

The Jurassic Period (205 to 140 mya) brought more change. Pangaea had begun to drift apart in the late Triassic and eventually formed two large continents, Gondwanaland and Laurasia, separated by the Tethys Sea. The climate was hot and dry in some places, with distinct seasons. Subtropical climates reached Arctic and Antarctic latitudes. In the forests, ancient relatives of pines, yews and bald cypresses towered over masses of ferns. Ginkgoes (maidenhair trees) flourished in northern latitudes. Now-extinct cycadeoids, resembling stumpy-looking palms, grew widely in the world's dry zones. Giant plant and meat-eating reptiles ruled the land. These were the largest land animals ever to roam the surface of the earth. Small, secretive mammals skittered about in the undergrowth. Birds, such as Archaeopteryx, joined pterosaurs (flying reptiles) in the air. Pterosaurs were the largest vertebrates ever to fly. Dinosaurs dominated the earth at this time and many new species developed. Ichthyosaurs and plesiosaurs lived in the warm oceans along with corals, sponges and other animals without backbones.

The Earth's climate mellowed during the Cretaceous Period (140 to 65 mya). Temperatures at the poles were only a few degrees cooler than at the equator. Conifers, cycads and ferns ruled the plant world in the early Cretaceous. Grasses had not arrived yet, so primitive forms of horsetails and ferns covered the ground. The evolution of flowering plants, about 125 mya, revolutionized global ecosystems, and by the late Cretaceous, flowering plants covered the land. This was a time of high tectonic activity (continental plate movement) and volcanic upheavals – many mountain ranges began to form, including the Rocky Mountains and the European Alps. By the end of the Cretaceous, the world's continents were beginning to look more like they do today. An enormous marine realm, the Tethys Ocean, separated southern-hemisphere continents from those in the north. The young Atlantic Ocean split Africa from South America and Europe from North America.

The Cretaceous ended with another mass extinction – the second largest in the history of life on earth. Dinosaurs, along with many other reptiles and other organisms fell victim. But the extinction of the dinosaurs was good news for mammals, which had waited in the shadows for so long. Now they could fill the gaps left by the dinosaurs.

No one is sure why all the dinosaurs died out, but scientists have put forth many theories. Some think that an asteroid hit the Earth, sending a cloud of dust up into the sky blocking out the sun and cooling the environment, killing plants and animals. Others think it may have been volcanic activity. Likely, several different changes affected global ecosystems on land and in the seas. The extinction of dinosaurs at the and of the Cretaceous was rapid, but the decline may have begun well before the catastrophic event delivered the fatal blow.