

## YANGCHUANOSAURUS

(yang-choo-AHN-o-SAWR-əs) “Yangchuan Lizard”

### CLASSIFICATION

Kingdom.....	Animalia
Phylum.....	Chordata
Class.....	Sauropsida
Superorder.....	Dinosauria
Order.....	Saurischia
Suborder.....	Theropoda
Family.....	Siinraptoridae
Genus.....	<i>Yangchuanosaurus</i>
Species.....	<i>shangyouensis</i>

### FOSSIL LOCATION

China



### SIZE

Length 9 m (29.5 ft)  
Height 2 m (6.5 ft)

### WEIGHT

900-1,100 kg  
(2,000-2,600 lbs)

### DIET

Carnivore

### LIFESPAN

Approximately  
20 years

### TIME PERIOD

**Yangchuanosaurus**  
Late Jurassic  
150.8-145.5 million years ago



**Triassic Period**  
250 - 201 million years ago

**Jurassic Period**  
200 - 146 million years ago

**Cretaceous Period**  
145 - 65 million years ago

### INTRODUCTION

The supercontinent **Pangaea** continued to drift apart during the Jurassic period, separating into **Gondwana** and **Laurasia** and creating the narrow Central Atlantic Ocean. By the Late Jurassic period (161–145.5 million years ago), sea levels were much higher than during the Triassic (251–201.6 million years ago) and had flooded vast areas to form shallow continental seas. No polar ice caps were present and the warm climate helped spread the temperate and tropical forests and rich river-valleys of China that were populated by *Yangchuanosaurus* and its prey.

*Yangchuanosaurus* was the largest and most fearsome predator in its ecosystem, filling the same **ecological niche** as its close American relative, *Allosaurus*. Like other carnivorous species, *Yangchuanosaurus* hunted the many sauropod and stegosaur species that lived in the prehistoric forests of China, such as the back-plated *Tuojiangosaurus multispinus*, *Chialingosaurus kuani*, and *Chungkingosaurus jiangbeiensis*.

### CLASSIFICATION

Paleontologists use two major systems for classifying organisms. Linnaean taxonomy uses overall physical similarity to place organisms into different groups. By contrast, cladistics seeks to create groups of organisms based on evolutionary relationships; these groups are called “clades.” Cladistic analysis focuses on important key traits and attempts to trace the inheritance of a trait among descendants of a common ancestor.

Dinosaur species were first divided into two distinct groups by paleontologist Harry Seeley: ornithischia, or bird-hipped dinosaurs, and saurischia, or lizard-hipped dinosaurs. Although it may seem illogical, it is from the lizard-hipped dinosaurs that today’s avian dinosaurs (birds) evolved. This is an interesting example of **convergent evolution** in which the backward pointing pubis seen in ornithischians and modern day birds actually evolved separately.

# Yangchuanosaurus

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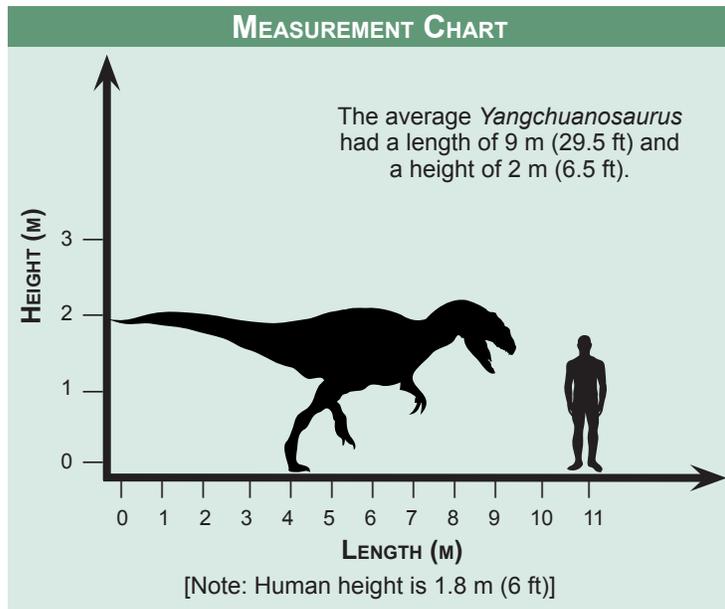


Under the Linnaean classification system, *Yangchuanosaurus* belongs to the saurischia order, which is comprised of two major groups—the large herbivorous sauropods and the predominately carnivorous theropods. *Yangchuanosaurus* is also part of the **theropoda** suborder, a group of bipedal, generally carnivorous dinosaurs united by developments of the skull, teeth and a few other skeletal features. The bipedal theropods are very diverse and among the oldest known dinosaurs, first appearing during the Late Triassic period about 230 million years ago. (Although theropod dinosaurs have historically been defined as carnivorous, recent research has indicated some of these species may have had more varied, even herbivorous, diets.)

Using a cladistic analysis, *Yangchuanosaurus* falls under the theropoda (“beast-footed”) clade, as it is bipedal. Theropods

are an extremely diverse group of dinosaurs that first appeared during the late Triassic period about 230 million years ago. The largest and most advanced theropod clade, tetanurae, first appeared in the fossil record during the Early or Middle Jurassic period (201.6–161 million years ago). Tetanurae is comprised of the spinosauroida (sometimes also referred to as megalosauroida), carnosauria, which includes *Yangchuanosaurus*, and coelurosauria, which includes *Tyrannosaurus*.

Carnosaurs include the allosauroids (comprised of four families: sinraptoridae, allosauridae, carcharodontosauridae, and neovenatoridae), which are generally characterized by their large heads and ornamental skull-crests, the most well-known of which is *Allosaurus*, a close North American relative of the Asian *Yangchuanosaurus*.



The *Yangchuanosaurus* genus was first established by Dong Zhiming in 1977. Current classification states there are three separate *Yangchuanosaurus* species: *Y. shangyouensis*, *Y. magnus*, and *Y. hepingensis*.

## ANATOMY

Although it was slightly smaller in stature, *Yangchuanosaurus* and its more famous relative *Allosaurus* were very similar in body structure and morphology. Both possessed a large head, short neck, long muscular hind legs, and massive tail. It is likely, in fact, that these two species occupied the same ecological and predator niche on their separate homelands of Asia and North America.

*Yangchuanosaurus* was the largest Asian predator during the Late Jurassic, possibly weighing upwards of 3,000 kg (6,600 lb) depending on the species. Like all lizard-hipped saurischian dinosaurs, *Yangchuanosaurus* possessed a backward-facing pubis bone and very large and long muscular hind legs, which ended with three-clawed toes on each foot. Its forearms were significantly shorter and each hand possessed three sharply clawed fingers. As is seen in almost all theropods, its greatly reduced forearms meant that *Yangchuanosaurus* was a bipedal dinosaur, with its long tail, almost half its 9-meter (29.5-foot) body, providing support and balance.

*Yangchuanosaurus* had a large and ridged skull, measuring more than 80 centimeters (31.5 inches) long and 50 cm (20 in) high, with a knob-like structure on the end of its nose. Anatomical adaptations such as the deep sinuses found in many of its skull bones meant that *Yangchuanosaurus*'s head

was light and hollow, which greatly improved its ability to smell, breathe, and hunt efficiently. It also possessed large, serrated, dagger-like teeth, which it used to feed on other dinosaurs.

## INTELLIGENCE

The most often used technique to measure and compare intelligence in animal species is the **encephalization quotient** (EQ), calculated as a body size to brain size ratio. With the exception of the troodontids (EQ of 5.8) and the dromaeosaurids (EQ of 5.7), all species of dinosaur fall below an EQ of 2.0. (In comparison, humans have an EQ of 7.44 and dolphins measure a 5.31).

Carnivorosity in dinosaurs usually indicates higher intelligence, and the majority of theropod carnivores were more intelligent than their herbivorous relatives. This is required to perform more complex behavior such as hunting. With an EQ between 1.0 and 1.9, *Yangchuanosaurus* ranks highly on the dinosaur intelligence scale. Although this ranking is low compared to modern day animals, recent neurological research has indicated that at least some dinosaurs may be of higher intelligence than indicated by their current EQ levels.

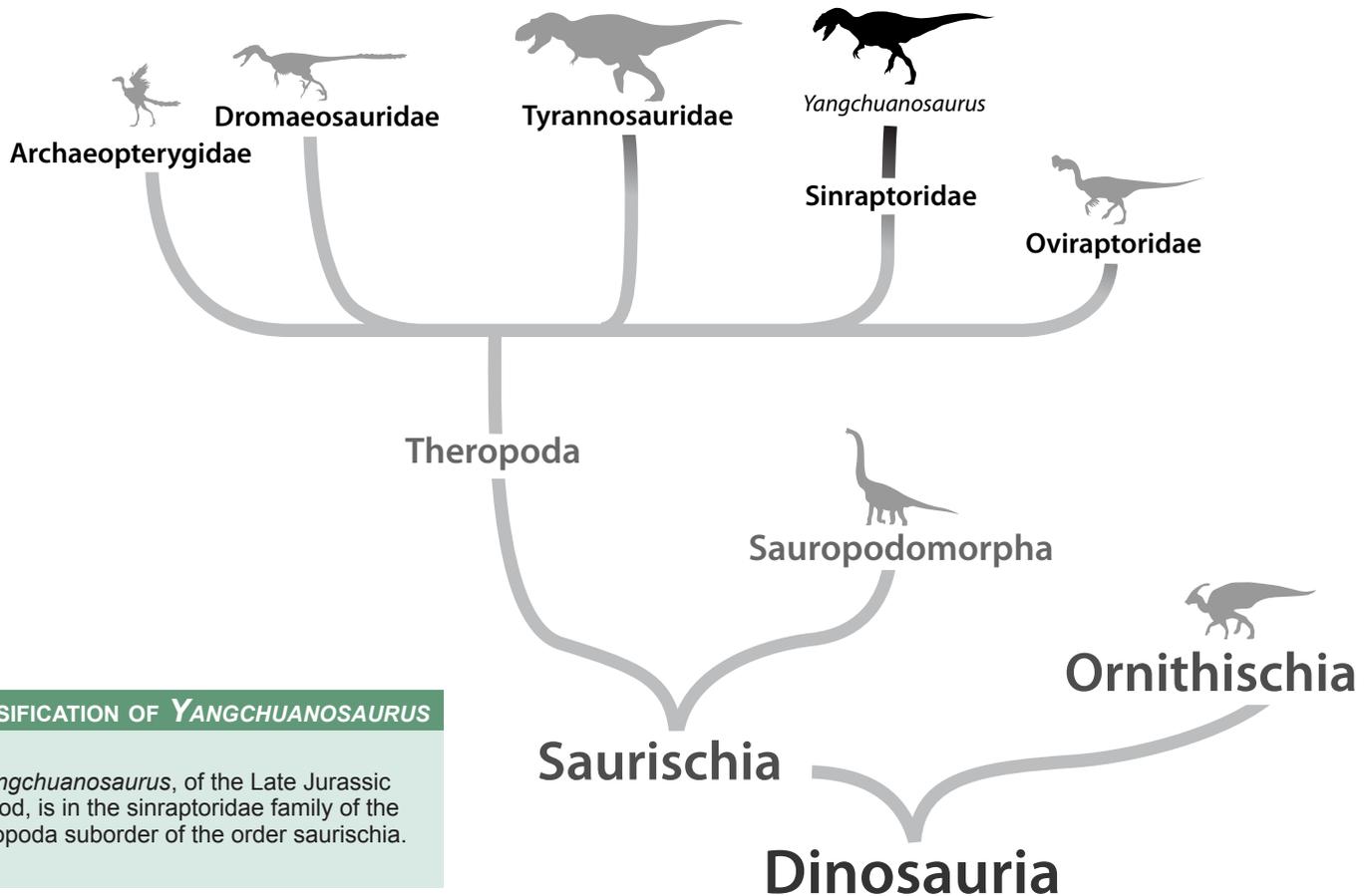
## REPRODUCTION & POPULATION

Allosaurid species were a very successful group of dinosaurs that appeared to exceed other carnivores in number, including the megalosaurs and ceratosaurs species present during the Late Jurassic. Allosaurs were widely distributed across many geographical regions during the Jurassic and Cretaceous periods, including Asia, North America, Europe, and Africa.

Most dinosaurs are thought to be **oviparous**, including *Yangchuanosaurus*, laying up to several eggs in a clutch. Egg-laying methods appeared to differ, however, ranging from laying eggs in nests, burying eggs underground, and perhaps even incubating eggs by brooding. Post hatching parental care behavior is considered possible, even probable, for some dinosaurs, but evidence remains inconclusive for many species.

## DIET

*Yangchuanosaurus* was the largest carnivore found in Late Jurassic Asia, and was a formidable predator with a large jaw, long curved teeth, and sharp slashing claws. It obtained energy to power its large body by consuming other dinosaur species, particularly herbivore species such as the medium-sized plate-backed stegosaurs and the long-necked sauropods. Recent fossil evidence has even indicated that *Yangchuanosaurus*



may have been strong enough to hunt sauropods as large as the impressive *Mamenchisaurus* species.

Anatomical adaptations, particularly the deep sinus spaces found in many of its skull bones, meant that *Yangchuanosaurus*'s head was light and hollow. This significantly improved its olfactory senses (sense of smell) and its ability to breathe efficiently. Smelling prey from long distances as well the ability to run much faster and further greatly improved its hunting capacities, and perhaps made it even more of a threat than its American contemporary, *Allosaurus*. *Yangchuanosaurus*'s forward-facing eyes also provided excellent sight with which to hunt, and its long tail helped maintain balance during the chase.

As with later predators, such as *Tyrannosaurus*, there is some debate as to whether *Yangchuanosaurus* was an active hunting predator or an opportunistic carrion (animal carcass) scavenger. However, the majority of paleontologists suggest that it was probably both—hunting when required and scavenging if the opportunity presented itself.

## BEHAVIOR

The discovery of well-preserved skeletons and partial remains of *Yangchuanosaurus* has provided paleontologists with the opportunity to describe the morphology and genus of this species in detail, and has helped highlight the possible behavior and probable living conditions of this carnosaur species.

It is considered likely that *Yangchuanosaurus* would have exhibited similar behavior to its close relative *Allosaurus*, prowling and hunting in the lush Asian forests its prey inhabited. Many paleontologists believe that allosaurid species, such as *Yangchuanosaurus*, may even have hunted in packs.

Recent fossil evidence of a healed wound in a *Yangchuanosaurus* scapula bone provides evidence of conflict behavior. Chinese scientists believe that a species with a club-like tail, such as *Mamenchisaurus hochuanensis*, may have inflicted such wounds. This paints a picture of conflict between carnivorous predator, *Yangchuanosaurus*, and large sauropod

herbivore, *Mamenchisaurus*. It indicates probable parental protection or defensive behavior from *Mamenchisaurus* and suggests that *Yangchuanosaurus* was large or strong enough to hunt this species.

## HABITAT & OTHER LIFE FORMS

The Jurassic was a period generally characterized by much higher sea levels, higher atmospheric CO<sub>2</sub> concentrations, and warmer temperatures than seen today. The landscape was covered with low-lying **gymnosperms** such as ferns, horsetails, cycads, and mosses, and tall trees such as Ginkgoes and conifers. **Angiosperms** did not appear until 140 million years ago during the start of the Cretaceous period and the landscape was absent of grass, which did not evolve until very late in the Cretaceous period (and possibly later).

Asia was home to a diverse collection of dinosaur species during the Late Jurassic period. *Yangchuanosaurus* inhabited the temperate and tropical forests and rich river-valleys of what is now central China, preying on the herbivores that fed on the lush green vegetation prevalent at the time. They lived alongside many other Asian dinosaurs, including the herbivorous and vastly long-necked sauropods *Omeisaurus* and *Mamenchisaurus*, back-plated dinosaurs such as *Tuojiangosaurus multispinus*, *Chialingosaurus kuani* and

*Chungkingosaurus jiangbeiensis*, and the tiny herbivore *Xiaosaurus*.

## RESEARCH

In 1977, an almost complete dinosaur skeleton was unearthed during the construction of a new dam in Yangchuan County of the Sichuan Province. The skeleton was the most complete specimen found in China, lacking only its forelimbs and parts of its backbone, and was collected from the dark-red mudstones of the Upper Shaximiao Formation of Sichuan. The remains were examined and named *Yangchuanosaurus shangyouensis* in 1978 by Dong Zhiming, a paleontologist from the Beijing's Institute of Vertebrate Paleontology and Paleoanthropology.

In 1983, a second, larger species was described and named *Yangchuanosaurus magnus* by Dong. Also recovered from the Upper Shaximiao Formation of Sichuan, this species shared many characteristics with the original *Yangchuanosaurus* species, but was larger in size. The third and smallest species was discovered in 1985 by local farmers in Heping, Sichuan. The remains were excavated from the red mudstones of the Upper Shaximiao Formation and were described and named *Yangchuanosaurus hepingensis* in 1992 by Gao Yuhui from the Zigong Dinosaurian Museum.

## VOCABULARY

**Angiosperms:** Flowering vascular seed plants, of which the earliest recognized species occurred in the Early Cretaceous period between 145 and 140 million years ago.

**Convergent Evolution:** When two or more distinct and unrelated species (that is, possessing different ancestries) evolve similar biologically characteristics to fulfill a specific function, such as flight exhibited, for example, in flying reptiles, bats, and birds.

**Ecological Niche:** The status or position of an organism or population within a specific ecosystem in relation to other species or populations in the same community.

**Encephalization Quotient (EQ):** Is a measure of an organism's intelligence, based on a ratio of brain size to body size. For dinosaurs, this measure falls somewhere between 0.1 and 5.8 and was developed by Harry J. Jerison in the 1970s and later expanded upon by paleontologist James A. Hopson.

**Gondwana:** One of the two land divisions (southern) that occurred during the break-up of the Pangaea supercontinent during a period of continental drifting during the Jurassic

(200 million years), consisting of what is now South America, Africa, Arabia, India, Madagascar, Antarctica and Australia.

**Gymnosperms:** The first seed plants to evolve, differing from angiosperms in regards to flowers and seed encasement, and first evolving in the upper Devonian (about 385 to 359 million years ago). Species include Ginkgoes, conifers, and cycads.

**Laurasia:** One of the two land divisions (northern) that occurred during the break-up of the Pangaea supercontinent during a period of continental drifting during the Jurassic (200 million years), consisting of what is now North America and most of Europe and Asia.

**Oviparous:** Organisms that lay eggs instead of live young, such that most embryonic development occurs outside of the female's body.

**Pangaea:** A supercontinent that contained all landmasses and existed more than 250 million years ago; meaning "all lands" in Greek.

**Theropoda:** A suborder of bipedal, generally carnivorous dinosaurs united by developments of the skull, teeth and a few other skeletal features.

Although species located in the Upper Shaximiao Formation, such as *Yangchuanosaurus*, have been traditionally classified as living during the Late Jurassic, recent invertebrate and plant fossil evidence has suggested that the Upper Shaximiao Formation might be classified as Late-middle Jurassic in age. If this is the case, *Yangchuanosaurus* may actually be older than is currently accepted.

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