**How Ankylosaurus was discovered and classified**

**Introduction:**

***Ankylosaurus*** is a genus of the *Thyreophoran* dinosaur. Scientists found fossils of *Ankylosaurus* between 66-68 million years ago in geologic formations in western North America. This dates to the very end of the Cretaceous Period, making it among the last of the non-avian dinosaurs. Barnum Brown named the genus *Ankylosaurus* in 1908, and the only species classified under the genus is ***Ankylosaurus magniventris (A. magniventris)***. To date, they have excavated a handful of specimens, but a complete skeleton has not yet been discovered. Though other members of *Ankylosauria* are represented by more extensive fossil material, they consider *Ankylosaurus* to be the archetypal member of its group.

**Description:**

**Appearance:**

The structure of much of the skeleton of *Ankylosaurus*, including most of the pelvis, tail, and feet is still unknown. *Ankylosaurus* was a quadrupedal animal. It had a broad, robust body, and its hind limbs were longer than its forelimbs. Its skull was low and wide with two horns pointing backwards from the back of the head, and two horns below these that pointed backwards and down. The front part of the jaws were covered in a beak with rows of small, leaf-shaped teeth further behind it. *Ankylosaurus* was covered in armor plates, or osteoderms, with bony half-rings covering the neck and a large club on the end of its tail. Scientists believe it was a slow-moving animal, able to make quick movements when necessary. Its broad muzzle indicates it was a non-selective browser. The Sinuses and nasal chambers in its snout may have been for heat and water balance or played a role in vocalization. They think the tail club may have been used in defense against predators or in intraspecific combat. While the appearance of the Ankylosaurus’ feet isn’t completely known, the hindfeet probably had three toes, as is the case in related animals. Bones in the skull and other parts of the body were fused, increasing their strength, and this feature is the source of the genus name. The dorsal vertebrae of the back had *centra* (or bodies) that were short relative to their width and their neural spines were short and narrow. The dorsal vertebrae were tightly spaced, which limited the downwards movement of the back. The cervical vertebrae of the neck had broad neural spines that increased in height towards the body. The front part of the neural spines had well developed entheses, which was common among adult dinosaurs and indicates the presence of large ligaments which helped support the massive head.

**Physical measurements:**

The *Ankylosaurus* is the largest known *Ankylosaurid* dinosaur, estimated to have been up to 6.25 meters (20.5 feet) long, 1.5 meters (4.9 feet) wide, and 1.7 meters (5.6 feet) tall at the hip. American paleontologist Kenneth Carpenter proposed this length based on the largest known skull (specimen NMC 8880), which is 64.5 cm (25.4 inches) long and 74.5 cm (29.3 inches) wide. The smallest known skull (specimen AMNH 5214) is 55.5 cm (21.9 inches) long and 64.5 cm (25.4 inches) wide and this specimen is estimated to have been 5.4 meters (18 feet) long and around 1.4 meters (4.6 feet) tall. The humerus (upper arm bone) was short and very broad, and about 54 cm (21 inches) long in specimen AMNH 5214. The femur (thigh bone) was very robust and 67 cm (26 inches) long in AMNH 5214. American science writer, Gregory S. Paul, estimated the weight of the animal at 6 tonnes (13,000 Ib).

## History of discovery

In 1906, during an American Museum of Natural History expedition led by paleontologist Barnum Brown, Peter Kaisen discovered the type specimen of *A. magniventris* (AMNH 5895) in the Hell Creek Formation near Gilbert Creek, Montana. The specimen consisted of the upper part of a skull, two teeth, part of the shoulder girdle, cervical, dorsal, and caudal vertebrae, ribs, and more than thirty osteoderms.

In 1910, there was another AMNH expedition led by Brown where they discovered an *Ankylosaurus* specimen (AMNH 5214) in the Scollard Formation by the Red Deer River in Alberta, Canada. This specimen included a complete skull, mandibles, the first and only tail club known of this genus, as well as ribs, vertebrae, limb bones, and armor. In 1947, fossil collectors Charles M. Sternberg and T.P. Channey collected a skull and mandible (specimen NMC 8880) a kilometre (0.6 miles) north of where the 1910 specimen was found. This is the largest known *Ankylosaurus* skull, but is badly preserved. A section of caudal vertebrae (specimen CCM V03) was discovered in the 1960s in the Powder River drainage, Montana, also part of the Hell Creek Formation. In addition to these five incomplete specimens, many other isolated osteoderms and teeth have also been found.

In 1990, American palaeontologist Walter P. Coombs pointed out that the teeth of two skulls referred to as *A. magniventris* differed from those of the holotype specimen in some details. Though he expressed a "considerate temptation" to name a new species of *Ankylosaurus* for these, he refrained from doing so, as the range of variation in the species was not completely documented. He also raised the possibility that the two teeth associated with the holotype specimen did not belong to it, as they were found in matrix within the nasal chambers. Kenneth Carpenter accepted the teeth as belonging to *A. magniventris* and that all specimens belonged to the same species, noting that the teeth of other Ankylosaurs are highly variable.

## Classification

Brown scientifically described the *Ankylosaurus* in 1908. He derived the genus name from the Greek words '*αγκυλος*/*ankulos* ('bent' or 'crooked'), referring to the medical term ankylosis, the stiffness produced by the fusion of bones in the skull and body and *σαυρος*/*sauros* ('lizard'). The name can be translated as "fused lizard", "stiff lizard", or "curved lizard". The type species name, A. *magniventris,* is derived from the Latin *magnus* ('great') and *venter* ('belly'), referring to the great width of the animal's body.Brown considered the *Ankylosaurus* so distinct that he made it the type genus of a new family, Ankylosauridae (members of which are called Ankylosaurids), typified by massive, triangular skulls, short necks, stiff backs, broad bodies, and osteoderms. He also classified *Palaeoscincus* (only known from teeth), and *Euoplocephalus* (then only known from a partial skull and osteoderms) as part of the family. In 1923, Palaeontologist Henry Fairfield Osborn coined the name “Ankylosauria” (members of which are called Ankylosaurs or Ankylosaurians), thereby giving the Ankylosaurids their own suborder. Due to the fragmentary remains, Brown was unable to fully distinguish between *Euoplocephalus* and *Ankylosaurus*. Only having few, incomplete members of the family to compare with, he believed the group was part of the suborder Stegosauria. Ankylosauria and Stegosauria are nowgrouped together within the clade Thyreophora. In addition to Ankylosauridae, Ankylosauria has been divided into the families Nodosauridae, and sometimes Polacanthidae (these families lacked tail clubs). The *Ankylosaurus* is considered part of the subfamily Ankylosaurinae (members of which are called Ankylosaurines) within Ankylosauridae.

**Style Sheet:**

**Name:** Sahana Melkris

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**Title of Document:** “How Ankylosaurus was discovered and classified”

**Style Manual:**

**Microsoft Style Guide, 2018:**

*Pages referenced: “Hyphens,” “Capitalization,” “Apostrophes,” “Numbers,” “Commas,” and “Acronyms.”*

* I included the Oxford comma as part of “Microsoft style guide > Punctuation > Commas”. An Oxford comma is added before the conjunction “and” in a list of three or more items.
* For titles, we capitalize the first word and lower case the rest according to “Microsoft Style Guide > Capitalization.”
* I removed a comma before the conjunction “and” as it was followed by a dependent clause, not an independent clause in sentence “The front part of the neural spines had well developed entheses, which was common among adult dinosaurs **and** indicates the presence of large ligaments which helped support the massive head.” According to “Microsoft style guide > Punctuation > Commas,” you need the comma before a conjunction between two independent clauses.

**The Chicago Manual of Style, 17th edition of text, 2017:**

*Pages referenced:* [*https://www.chicagomanualofstyle.org/search.epl?q=genus&site=cmosfaq&search\_edition=16*](https://www.chicagomanualofstyle.org/search.epl?q=genus&site=cmosfaq&search_edition=16)

* Genus name should be in italics and capitalized
* All levels above genus are capitalized but not in italics
* All levels below genus, like species, are in italics and lower case
* Species name is always written with genus name first, where genus name is spelled out in first instance and abbreviated in later instances like (*A. magniventris*)

**Dictionary:** New Oxford American Dictionary, 4th edition