

## ERECT NECK CARRIAGE AND TALL SHOULDERS IN HIGH BROWSING TACHYMETABOLIC SAUROPODS

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Long necks are the ultimate adaptation for high browsing, because such big, complex structures will not evolve to carry out low browsing activities that shorter necks can perform. High set shoulders are another classic high browsing adaptation. A survey of sauropod taxa shows that over half had moderately to very tall shoulders (camarasaur, euhelopids [incl. mamenchisaur and omeisaur], brachiosaur, some titanosaur and a cetiosaur). Tall shoulders tend to favor an erect neck carriage. Three *Camarasaurus* specimens have an identical upwards flexion of the neck base that proves they habitually carried their necks erect. Two *Euhelopus* specimens show a similar flexion at the cervo-dorsal juncture, as did the original articulated *Mamenchisaurus* skeleton. Diplodocids were the only sauropods with short shoulders and horizontal neck carriage, these tail-heavy sauropods were well adapted for rearing up. Erect neck carriage and tall shoulders confirm that the ultra tall archosaurs were primarily high browsers. They needed gigantic hearts to pump blood at super high pressures up to high held brains. These perpetually hard working organs produced very high rates of minimal oxygen consumption.

## THE SIZE AND BULK OF EXTINCT GIANT LAND HERBIVORES

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Multi-view skeletal restorations were used to make volumetric models of giant herbivores. The reliability of the method was tested and supported by the good agreement between the restored and actual masses of an elephant and a rhino. The results indicate that extinct land giants often were not as big as claimed. The mass of a 3.7 m tall mammoth was 8 tonnes, 4.1 m examples about 11 tonnes. 4.8 m tall indricotheres were rather gracile at 16 tonnes. Brontotheres reached 5 tonnes. The biggest known iguanodonts and hadrosaurs were surprisingly massive at 10 to 25 tonnes. *Diplodocus* was similar to mammoths in volume and had a mass of 11 tonnes. Most *Apatosaurus* specimens matched indricotheres in overall volume and tonnage at 18 to 20 tonnes, large specimens reached 23 tonnes. *Seismosaurus* had a relatively large tail supported by a stoutly built pelvis, but was intermediate to the two prior diplodocids in body size and total mass, and was not much longer than 30 m (lengths up to 52 m cannot be supported). *Supersaurus* was up to 55 tonnes, and at 35 to over 40 m is the longest known tetrapod. *Camarasaurus* was a moderate sized sauropod at 15 to 18 tonnes. African and American *Brachiosaurus* were 45 to 55 tonnes. The biggest known titanosaur reached 60 to 80 tonnes.