

MATH FOR PHYSICS

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For a Long Neck, Don't Chew

Sauropods had the longest necks for their body size of any dinosaur, and biologists think the animals were able to develop such long necks in part by not chewing.

Sauropod skulls were lightweight, without molars. The herbivores used their teeth to cut, strip and swallow huge quantities of vegetation, which were then slowly digested in their cavernous guts. Not pausing to chew gave the animals more time to consume the calories required by their huge bodies.

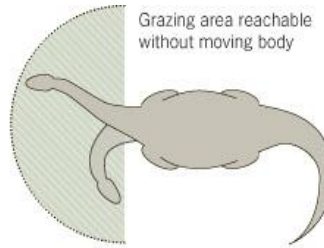


Brachiosaurus skull

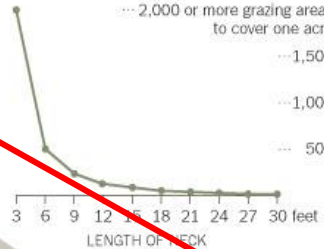
EFFICIENT GRAZERS

Lightweight skulls and vertebrae allowed sauropods to develop extremely long necks, useful for grazing large swaths of vegetation without moving a step.

Sauropods may or may not have been able to raise their heads high into trees, but while a large herbivore with a short neck would need to move thousands of times to graze an acre of vegetation, a long-necked sauropod might only need to move a few dozen times.



Grazing area reachable without moving body



LARGE REPTILE AND MAMMALS, FOR COMPARISON



Sources: "Biology of the Sauropod Dinosaurs"; Science

THE NEW YORK TIMES

INTRODUCTION: A life-size model of a female Mamenchisaurus, 60 ft Long, was recently placed on display at the American Museum of natural History in New York City. With a 30 ft neck it is stated(at left) this dinosaur species was able to graze one acre (43,560 ft²) in a few dozen times.

QUESTIONS: (a) With a 30 ft neck determine the area(ft²) it could graze without moving? **HINT:** Note in the graphic above the graze area is ½ the Area of a circle. (b) Show that a long-necked Sauropod might only need to move a few dozen times to eat one acre of vegetation?

Giants Who Scarfed Down Fast-Food Feasts

Nothing in the dinosaur world was quite like the sauropods. They were huge, some unbelievably gigantic, the biggest animals ever to lumber across the land, consuming everything in sight. Their necks were much longer than a giraffe's, their tails just about as long and their bodies like an elephant's, only much more so.

Wide-eyed first graders are not the only ones fascinated by sauropods, particularly those outsize friends Apatosaurus (formerly known as Brontosaurus), Brachiosaurus and Diplodocus. Scientists are redoubling their study of the unusual biology of these amazing plant-eaters. They are asking questions not unlike, in spirit, those of schoolchildren.

By what physiological strategy of heart, lungs and metabolism were the largest of sauropod species able to thrive over a span of 140 million years? How did they possibly get enough to eat to grow so hefty, to lengths of 15 to 150 feet and estimated weights of up to 70 tons? A mere elephant has to eat 18 hours a day to get its fill. Even in the Mesozoic era, there were only 24 hours in a day. A centerpiece of the show will be a life-size model of a 60-foot female

Mamenchisaurus, whose fossilized bones were discovered in China. An early and not especially large sauropod, it lived 160 million years ago, laid eggs and possibly lived in a herd. **It weighed 13 tons and ate 1,150 pounds of vegetation a**

day. The model focuses attention on the animal's 30-foot neck and small skull and jaws to illustrate the remarkable biology and behavior of sauropods.

The animals had the longest necks for their body size of any dinosaur

By not chewing their food, the animals had no need for a full set of large teeth or strong jaws and associated muscles.

They had only incisors up front for cropping and cutting vegetation. **As a result, their heads remained small and**

lightweight. A plant-chewing African elephant, for example, has a 1,000-pound head; a Mamenchisaurus head

weighed 45 pounds. A small head, of course, took a load off the sauropod neck, presumably allowing it to grow longer.

Even so, the neck had to be bolstered with more vertebrae than mammals have. These bones are light for their large

size, because they are hollowed out with many air pockets. Mammals, even the giraffe with a six-foot neck, are limited