

## Slender Giants

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The giant sauropod dinosaurs are often perceived as having a single uniform body plan: in fact there is great variation between different sauropods. For example, *Apatosaurus* has much more robust limbs than the closely related *Diplodocus*. The brachiosaurids *Brachiosaurus* and *Giraffatitan* have disproportionately narrow dorsal centra compared with diplodocids. They also have the slenderest humeri of all sauropods -- both by length:width ratio, and in proportion to their own femora, which are about 50% bigger in cross-sectional area. This is surprising, as their tall, broad torsos and small tails meant they carried more of their weight on their forelimbs than other sauropods. Exacerbating this paradox, the coracoid of *Brachiosaurus* has a unique ventrolaterally oriented glenoid articulation -- perhaps suggesting a mechanically inefficient sprawled posture, putting the slender humeri under great stress. The femora of brachiosaurids pose another puzzle, being more eccentric than those of other sauropods: the mediolateral width is more than twice the anteroposterior diameter for most of the length of the shaft. The humerus of *Giraffatitan* is 5% longer than the femur; the humerus of the *Brachiosaurus altithorax* holotype is eroded at its distal end, but reasonable reconstructions suggest that it too was longer than its femur when complete. The radius and ulna of *Giraffatitan* are also longer than the tibia and fibula, and the forefoot much taller than the hindfoot. These proportional differences show that the shoulders of brachiosaurs were even higher, relative to the hips, than most current restorations show.