

THE EVOLUTION OF GIGANTISM IN WHALES AND SAUROPODS: CONTRASTING SOLUTIONS TO COMMON PROBLEMS

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The largest animals to ever exist are baleen whales and sauropod dinosaurs. Both clades provide opportunities to investigate the evolutionary causes and constraints of extreme gigantism. Blue whales (*Balaenoptera musculus*) are the most massive known animals, including specimens of 190 metric tons or more. The largest sauropods are incompletely known; even so, there is no evidence for sauropods larger than 150 metric tons. It is debatable whether whales have reached the maximum size possible with their body plan; the largest known whales evolved recently and are still extant.

In both clades, the evolution of gigantism is associated with specializations related to skeletal support and locomotion, feeding, and life history. Whales traded the demand of support in a gravity field for the constraint of moving through a dense medium; their bauplan is governed primarily by hydrodynamics. Sauropods evolved heterogeneous skeletal density, with dense, columnar limb bones and light air-filled vertebrae. Rorquals and sauropods share a large gape relative to head size and minimal oral processing of food. In addition, both exploit large feeding volumes, rorquals by efficient entrapment of vast amounts of food in a single lunge, and sauropods by repeatedly evolving necks longer than 10 meters. Whales and sauropods are at opposite ends of the life history spectrum; whales produce and nurse a single huge calf per season, whereas sauropods laid hundreds of eggs in dozens of buried nests each season, and practiced little or no parental care. Both whales and sauropods show accelerated growth rates relative to their outgroups.