

Rates and modes of body size evolution in early carnivores and herbivores: a case study from  
Captorhinidae

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## ABSTRACT

Body size is an extremely important characteristic, impacting on a variety of ecological and life-history traits. It is therefore important to understand the factors which may affect its evolution, and diet has attracted much interest in this context. A recent study, examining the evolution of the earliest terrestrial herbivores in the Late Carboniferous and Early Permian, concluded that in the four herbivorous clades examined there was a trend towards increased body size, and that this increase was more substantial than that observed in closely related carnivorous clades. However, this hypothesis was not based on quantitative examination, and phylogenetic comparative methods provide a more robust means of testing such hypotheses. Here, the evolution of body size within different dietary regimes is examined in Captorhinidae, the most diverse and longest lived of these earliest high fibre herbivores. Evolutionary models were fit to their phylogeny to test for variation in rate and mode of evolution between the carnivorous and herbivorous members of this clade, and an analysis of rate variation throughout the tree was carried out. Estimates of ancestral body sizes were calculated in order to compare the rates and direction of evolution of lineages with different dietary regimes. Support for the idea that the high fibre herbivores within captorhinids are being drawn to a higher adaptive peak in body size than the carnivorous members of this clade is weak. A shift in rates of body size evolution is identified, but this does not coincide with the evolution of high-fibre herbivory, instead occurring earlier in time and at a more basal node. Herbivorous lineages which show an increase in size are not found to evolve at a faster rate than those which show a decrease; in fact it is those which experience a size decrease which evolve at significantly higher rates. The opposite is true of the carnivorous lineages, suggesting that in captorhinids it is the carnivores which show the greater trend towards increased body size. It is possible the shift in rates of evolution is related to the

improved food processing ability of the more derived captorhinids rather than a shift in diet, but the evidence for this is circumstantial.