

**THE EVOLUTION OF THE THEROPOD SHOULDER APPARATUS LEADING UP TO BIRDS: AN INTEGRATED APPROACH**

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The morphological transformation of non-avian theropod anatomy to yield the avian flight apparatus is one of the most intriguing transitions among vertebrates. The theropod scapulocoracoid is an integral component of this flight apparatus, and its evolution is investigated using a combination of systematically based comparative anatomical and morphometric analyses on fifteen non-avian and avian theropods. The morphological trends revealed via descriptions and comparisons of these terminal taxa are subsequently compared to the results of thin-plate spline analysis, allowing for a more objective assessment of shape changes observed in the scapulocoracoid. Comparisons of terminal taxa allow general morphological trends of the scapulocoracoid to be identified, and for highly autapomorphic forms to be recognized and consequently omitted from arguments of transformation. Thin-plate splines also permit graphical reconstruction of hypothetical ancestral forms situated at the internal nodes within a cladogram by using squared-change parsimony. The transformations inferred for the hypothetical ancestors, which represent more accurately the true line of descent, are compared to the transitions between the terminal taxa.

In order to evaluate changes in the size and performance of the shoulder girdle musculature during this transition, theropod shoulder girdle musculature is reconstructed, based upon phylogenetic and functional inferences, employing comparisons of the crocodylian and avian musculature as the extant phylogenetic bracket. Identification and comparison of osteological correlates of theropod shoulder musculature across theropod groups, and areas of shape change in the scapulocoracoid as revealed by anatomical comparisons, allow muscular changes to be mapped onto structural intermediates leading up to birds.

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