



New Directions in the Study of Fossil Endocasts: a Symposium in Honor of Harry J. Jerison,  
Thursday 8:45

## **MORPHOLOGICAL PATTERNS AND PHYLOGENETIC TRENDS IN THEROPOD BRAINCASE PNEUMATICITY**

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The braincases of theropod dinosaurs are generally highly pneumatic, and the often complicated systems of air chambers have become important phylogenetic characters. The individual identities, detailed morphological conformations, and homologies of the bony recesses, however, remain poorly resolved, undercutting their phylogenetic utility. Moreover, testing functional hypotheses (e.g., audition) cannot begin until these fundamental problems are addressed. As part of a larger study of braincase pneumaticity in Archosauria, we have identified at least three systems that are involved in pneumatizing the braincase—the median pharyngeal, subcondylar, and paratympanic systems—all three of which are variably present in theropods. Dozens of theropod braincases thus far have been subjected to CT scanning and 3D visualization, including the ceratosaurs *Ceratops* and *Majungasaurus*, the basal tetanurines *Allosaurus*, *Marshosaurus*, and *Acrocanthosaurus*, the tyrannosaurids *Gorgosaurus* and *Tyrannosaurus*, the ornithomimids *Gallimimus* and *Struthiomimus*, the oviraptorosaurs *Avimimus* and *Citipati*, the alvarezsaurid *Shuvuuia*, and the deinonychosaurs *Byronosaurus*, *Saurornithoides*, *Troodon*, *Dromaesaurus*, *Deinonychus*, and *Tsaagan*, and numerous birds. This study goes beyond presence/absence data to include parameters such as relative volumes, interconnections, and relationships to other systems (e.g., neurovasculature). Pneumatic attributes are variable among theropods, but patterns are emerging. Some sinuses are very consistent and present in all theropods (rostral tympanic recess) or restricted to certain groups (caudal tympanic recess in coelurosaurs). Other recesses are more erratic in their distribution. For instance, elements of the mandibular arch (quadrate, articular) are pneumatic in tyrannosaurids, some ornithomimids, at least one carcharodontosaurid, troodontids, and birds, but not dromaesaurids. There is a general trend for increasing diversity and extent of sinuses on the theropod line to birds.