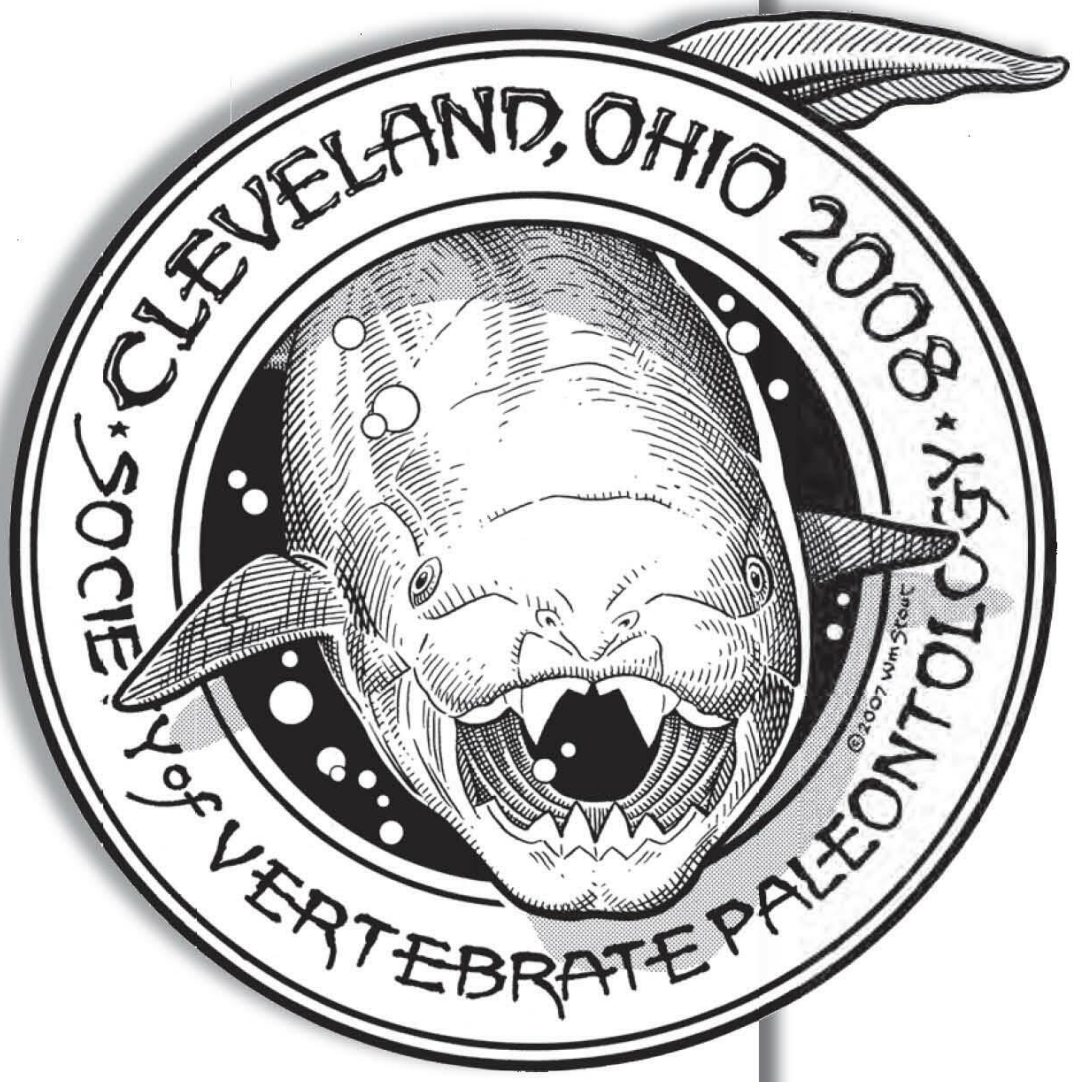
Volume 28, Supplement to Number 3
September 2008

JVP

Journal of Vertebrate Paleontology
Program and Abstracts



68th Annual Meeting
Society of Vertebrate Paleontology

Cleveland Museum of Natural History
Case Western Reserve University
Renaissance Cleveland Hotel
Cleveland, Ohio USA
October 15-18, 2008

New Directions in the Study of Fossil Endocasts: a Symposium in Honor of Harry J. Jerison, Thursday 9:15

GROSS ANATOMICAL BRAIN REGION APPROXIMATION (GABRA): A NEW TECHNIQUE FOR ASSESSING BRAIN STRUCTURE IN DINOSAURS AND OTHER FOSSIL ARCHOSAURS

RIDGELY, Ryan, Ohio University, Athens, OH, USA; WITMER, Lawrence, Ohio University, Athens, OH, USA

Tracking brain evolution through the fossil record has proven difficult, because a cast of the bony endocranial cavity is the only proxy available for study. A cranial endocast is a fair representation of brain size and form for some groups (mammals, birds), but for many reptile groups the brain does not completely fill the cranial cavity, and an endocast is a poor proxy. Thus, quantitative studies of relative brain size or qualitative studies of brain region evolution often require untested assumptions. We present a new technique called Gross Anatomical Brain Region Approximation (GABRA) which addresses these problems by using 3D digital analysis to estimate brain size and morphology in fossil taxa based on a variety of comparative anatomical criteria. Based on hundreds of virtual endocasts of extant and extinct archosaurs generated from our CT data, we have identified a large suite of homologous endocast features (neurovascular canals, dural sinuses, fossae produced by the brain itself, etc.) that have highly conserved relationships to the regions of the brain. These criteria provide limits on the location and size of major brain regions (e.g., cerebral hemispheres, cerebellum, optic lobes, olfactory bulbs) in fossil taxa, and allow the production of a 3D model of the inferred brain morphology. As examples, the digital endocasts of *Euoplocephalus, Pachyrhinosaurus, Camarasaurus,* and *Majungasaurus* were imported into modeling software (Maya). Virtual models of the underlying brain regions were produced within the endocast using 3D ellipsoids constrained by the anatomical criteria noted above. The reconstructed brains are credible and testable hypotheses, revealing, among many other things, that the sauropod had much more extensive venous sinuses than did either ornithischian, with the theropod being intermediate. GABRA allows moving beyond studying the endocast as a singular entity to studying the evolution of the brain and its different parts, allowing hypotheses of neurological mosaic evolution to be better tested. Moreover, revised estimates of brain (and brain region) size will put quantitative analyses on a better footing.