Rules of Construction in Proboscis Building in Mammals

Clifford, Andrew B., and Witmer, Lawrence M.; Ohio University, Athens, OH, USA (andrew.clifford@brown.edu)

Fossil mammals with retracted nasal bones are commonly reconstructed with fleshy, tapir-like probosces. Extant mammals, however, show a variety of proboscis structures and not all have retracted nasals. We studied a diversity of extant probosces to determine causal relationships between soft-tissue specializations and underlying bony changes. Study specimens and outgroups were examined through CT, dissection, sectioning, and skeletonization, or were studied from the literature. Mammals show two large-scale anatomical conformations or styles of probosces. Maxillolabial probosces result from elongation of the rostral end of the nose, without retracted nasals, relying largely on maxillolabial musculature. Vestibular probosces show variable specializations in soft tissues, yet the nasal vestibule is always enlarged, causing retraction of the bony nostril. Vestibular probosces do not show increased capacities for more primitive functions such as olfaction or respiratory countercurrent exchange. Phylogenetic constraint and exaptation underscore the importance of outgroup anatomy and the anatomical substrates involved. Maxillolabial probosces leave few osteological correlates, and retracted nasals in vestibular probosces serve only as starting points in reconstructing a proboscis. Correlates for major soft-tissue structures (e.g., cartilages, muscles) provide rules of construction for proboscis building and for discriminating among functionally divergent conformations in vestibular probosces. These data permit proboscis inference to more adequately characterize narial specializations seen in fossil mammals and to clarify their behavioral and ecological roles.