HOMINOID BRAIN ORGANIZATION: HISTOMETRIC AND MORPHOMETRIC COMPARISONS OF VISUAL BRAIN STRUCTURES

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Abstract of dissertation

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The visual system is the largest sensory modality in modern humans (*Homo sapiens,* herein referred to simply as "humans") and closely related species, and the size and organization of human visual brain structures have played a central role in discussions of brain evolution. It has been argued that changes in the relative sizes of visual system structures prior to encephalization provide evidence of reorganization in the human lineage. Yet very little is known about the organization of the visual brain structures in the taxa phylogenetically closest to humans – the apes – thus making it difficult to evaluate hypotheses about recent evolutionary changes. Here, visual brain structures -- the lateral geniculate nucleus (LGN), the primary visual cortex (V1), and three extrastriate areas (V2, VP and V5) -- are compared at several anatomical levels in hominoid species. First, the histological organization of hominoid striate and extrastriate cortical areas are compared in terms of cell volume densities and laminar patterns. Second, hominoid visual brain structure volumetric data are used to determine whether the human brain departs from hominoid and other primate patterns of brain organization. V1 volumes are then compared to lunate sulcus position to investigate the reliability of inferences about brain reorganization made on fossil hominin endocasts. Third, the LGN laminar pattern is investigated in catarrhine species. The results indicate that hominoid visual brain structures show evidence of reorganization at multiple anatomical levels. Humans are found to have relatively reduced V1 and LGN volumes. Chimpanzees and bonobos differ from each other in the size and histological organization of visual areas. Apparent similarities in the visual systems of macaques and humans are reevaluated due to differences between cercopithecoids and hominoids in visual brain structure scaling relationships, and also homoplasy in LGN structure within the catarrhines. The data obtained for this study suggest that interspecific variability in visual system structures can arise independently of global brain and body size scaling relationships.