

hyperostosis than subadults (45%). While there are no statistically significant differences between cemeteries for pathology, there are significant differences between adults and subadults for cribra orbitalia and scorbutic lesions, lending support to a relationship between cribra orbitalia and vitamin C deficiency. Overall, it seems that environmental context and resource availability were the main contributors to health in both samples, while the cribra orbitalia and scorbutic lesions may indicate that weanling diets were deficient in vitamin C.

Assessing site specific Changes in endocranial shape associated with frugivory in primates.

DELANIE R. HURST¹, P. THOMAS SCHOENEMANN¹, BRIAN B. AVANTS² and JAMES C. GEE². ¹Anthropology, Indiana University Bloomington, ²Radiology, University of Pennsylvania School of Medicine.

Three hypotheses have prevailed in anthropology as the driving force of increased encephalization in primates: tool use, sociality and frugivory. Frugivory has been specifically targeted as a behavioral correlate with brain size as the temporal and spatial specificity of ripe fruit presumably requires the use of mental maps and is calorically better suited for a large, energetically expensive brain. For *Hominins*, fossilized endocranial surfaces provide the most direct evidence of brain evolution; yet endocasts may reflect only a fraction of the actual variation in brain anatomy. In the present study non-rigid deformation techniques were used to quantify localized variation in endocranial morphology across 19 non-human primate specimens using CT scans from the Open Research Scan Archive. Behavioral data on the percentage of fruit in each species diet was extracted from the literature. Correlations were calculated between these behavioral variables and the degree of localized distortion required to morph each species' endocranial form into a common atlas (*Pan troglodytes*). Maps of the endocranial surface illustrating these correlations on a voxel-by-voxel basis suggest that frugivory may be specifically associated with endocranial shape in the following areas: rostral prefrontal, lateral cerebellum and inferior temporal. These results suggest that it might be possible to infer level of frugivory in the primate fossil record from endocasts.

Thanks to NSF for funding ORSA

Regional integration, subsistence, and health during the Formative Period in the Lake Titicaca Basin.

DALE L. HUTCHINSON^{1,2}, SARA JUENGST^{1,2}, KAREN L. CHAVEZ³, SERGIO J. CHAVEZ³, LYNETTE NORR⁴ and THERESA SCHOBER⁵. ¹Anthropology, University of North Carolina, Chapel Hill, ²Research Laboratories of Archaeology, University of North Carolina, Chapel Hill, ³Department of Sociology, Anthropology, and Social Work, Central Michigan University,

⁴Office of the Attorney General, State of Florida, ⁵Anthropology, University of Florida.

The Middle Formative Period (800-100 B.C.) in Bolivia was characterized by the emergence of complex societies, regional integration, and an increase in long-distance trade. Central to the regional integration of the Middle Formative was a ritual tradition known as the Yaya-Mama. In this presentation, we address two principle hypotheses: 1) maize was a dietary component during the Middle Formative, and 2) that maize consumption varied between individuals interred in temple contexts, perhaps as part of ritual activities, as compared to those interred elsewhere. Burials from one temple and three non-temple sites were examined dating between 550 B.C. and 10 B.C. Stable carbon $\Delta 13C$ ca-co signatures for all Yaya-Mama A-C individuals (6.2), reflective of whole diet, suggest that maize may have been consumed, although not as a dietary staple. Pathological lesion rates would seem to support such an observation. While carious lesions (49% of all Yaya-Mama A-C individuals) are common, the frequency is not overwhelming. Differences in the nitrogen and carbon signatures of temple individuals ($\delta 15N=8.6$; $\Delta 13C$ ca-co=6.4) as compared to those not interred in temples ($\delta 15N=7.8$; $\Delta 13C$ ca-co=5.7) would suggest that those two broad groups had different diets. Higher rates of carious lesions (51%) for Ch'isi temple individuals as compared to those who were not interred in the temple (38%) would also suggest a diet which incorporated additional enriched plant foods, potentially maize.

Funding for the archaeology of the project was provided by grants from The National Geographic Society and Central Michigan University. Funding for the stable isotope and pathology analyses was provided by grants from East Carolina University, the University of North Carolina at Chapel Hill, and the Wenner-Gren Foundation.

An assessment of the growth and development of the pediatric tongue and mandible within a South African population.

ERIN F. HUTCHINSON¹, JULES A. KIESER² and BEVERLEY KRAMER¹. ¹School of Anatomical Sciences, University of the Witwatersrand, ²Sir John Walsh Research Institute, University of Otago.

Studies assessing juvenile osteology have focused on age and sex related changes in the fetal and post-childhood mandible. However, few have assessed the relationship between the mandible and the growth and development of the tongue. The aim of this study is to evaluate the relationship between the growth of the mandible and tongue in a South African pediatric population (20 gestational weeks to 3 years). Our sample consisted of 171 pediatric cadaver specimens from the Pediatric Collection, University of the Witwatersrand. Osteometry was assessed using a microscribe G2 on 30 mandibular landmarks. These were digitized and converted to linear distances, to assess changes in the overall dimensions of the mandible. Osteometric dimensions included maximum

mandibular length, mandibular body length, bigonial and biantegonial widths of the mandible, interforaminal width of the mental foramina, distances between the superior and inferior borders of the mandible and mental foramen and calculated mandibular and mental angles. Tongue dimensions included the maximum and minimum tongue lengths and breadth. These were assessed using a manual sliding caliper. Statistical analysis included size and shape assessments. Size assessments included the geometric mean and analysis of variance (ANOVA). Shape assessments included Mosiman's shape variables, multivariate analysis of variance (MANOVA) and selected geometric morphometric analyses. Statistically significant increases were noted across all groups assessed. All significant increases occurred in the posterior region of the mandible, which was well correlated with tongue dimension increases. Hence, we conclude that mandibular growth is influenced by accommodation of dimensional changes of the tongue.

Three-dimensional geometric morphometric analysis of Late Pleistocene femora: Taxonomy and functional morphology .

VANCE T. HUTCHINSON. Anthropology, Tulane University.

FH Smith has elegantly described the distinctive craniofacial morphology of the Neandertals as a 'gestalt' of additive variation in numerous morphometric features that does not include unequivocal taxonomically relevant autapomorphies. Three-dimensional geometric morphometric analysis of 46 landmarks on the complete femur identified a similar pattern of low-level variation among Neandertal and Late Pleistocene Eurasian and recent modern human femora. Individual shape components did not discriminate the Neandertals as a group from modern humans and thus cannot be considered useful for taxonomic assignment of isolated partial femora. However, discriminant function analysis successfully identified Neandertal femora based on subperiosteal shape differences in complete femora from comparative samples representing modern humans spanning the Eurasian Upper Paleolithic to the present. Thus the cumulative variation in the complete femur does provide some taxonomic information. Significantly, the patterns of variation in the geometric relationships of shape components of partial and complete femora are consistent with morphological trajectories resulting from some combination of body mass and activity level differences in *in vivo* mechanical loading. Thus three-dimensional geometric morphometric methods are robust for investigation of functional geometries in the human locomotor skeleton.

A new look at frontal bone ontogeny.

CAITLIN L. IBARRA¹ and GARY D. RICHARDS². ¹Department of Anthropology, California State University East Bay, ²Biomedical Sciences, University of the Pacific.