ical relationship between estrogen and thyroid hormones during pregnancy.

**Ontogenetic variation in *Homo* and *Pan* mandibles: a 3D geometric morphometric approach.**

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Shape variation in extant hominid mandibles has been widely investigated. However, there is still an ongoing debate on whether inter-specific morphological differences can be attributed to the direction and pattern of ontogenetic trajectories. In the present study, we re-examine patterns of ontogenetic shape change in 187 subadult and adult humans, bonobos and chimpanzees. We propose that ontogenetic shape differences in the mandible are influenced not only by diverging ontogenetic trajectories among taxa, but also by differing patterns of ontogenetic shape changes in the corpus and ramus.
We employ Procrustes based geometric morphometrics to quantify and analyse mandibular form. Thirty 3D landmarks were recorded on the entire mandible and these were analysed together as well as separately as corpus and ramus elements. Principal components analyses in shape-space and form space, multivariate regressions as well as taxa mean shape comparisons were used to examine patterns of ontogenetic shape variation across chimpanzees, bonobos and humans. Our results suggest that ontogenetic trajectories of shape change in *Pan* and *Homo* are linear, but not entirely parallel. Moreover, shape differences among the taxa are established early in postnatal ontogeny. Separate analyses of the corpus and ramus show that these two regions are semi-independent of each other in their pattern of ontogenetic shape changes. The latter provides support for the functional matrix hypothesis and serves as an additional explanation for divergent patterns of shape change in closely related hominid taxa. These results also emphasize the need for further research on integrative aspects of the primate mandible.
This study was funded by Marie-Curie ("EVAN") Action grant MRTN-CT-2005-019564.

**Juvenile cranial shape variation and superstructure development in African papionins.**

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The discovery of *Rungwecebus* (Cercopithecinae: Papionini), which is currently known only from juvenile voucher specimens, has spurred interest in the relationship between juvenile papionin cranial morphology and adult cranial form. Several studies have demonstrated that diagnostic shape differences are present prior to M1 eruption, but many phylogenetic characters are difficult to evaluate in juveniles. For example, the two African papionin clades are distinguished by their temporal and nuchal line conformations, but these features, which develop in response to mechanical loading, achieve full expression only in mature adulthood. However, if the influence of the cranial musculature merely modulates existing neurocranial shape differences, shapes of the frontal and occipital bones would be expected to differ between juveniles of the two clades.
To test this hypothesis, geometric morphometric analyses of frontal and occipital shape were conducted on M1-stage crania (n=30) representing all African papionin genera except *Theropithecus*. In each analysis, 3D landmarks (21 frontal; 17 occipital) were subjected to generalized Procrustes and principal components analyses to explore taxonomic shape variation. In both analyses, the first principal shape component (PSC1) summarized allometric variation, while subsequent components reflected phylogenetic shape differences. Frontal PSC2 summarized differences between the *Cercocebus/Mandrillus* and *Lophocebus/Papio/Rungwecebus/Theropithecus* clades in coronal suture location, frontotemporal suture length, and prominence of glabella. Occipital PSC3 separated the clades on the basis of occipital proportions and inion position, but *L. aterrimus* was more similar to *Cercocebus/Mandrillus*. These results suggest that in African papionins, epigenetic influences amplify early-arising neurocranial shape differences to yield phylogenetically diagnostic adult cranial superstructures.

**The role of landscape in shaping contemporary genetic structure in the chacma baboon (Papio ursinus).**

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A published phylogeny of *P.ursinus* estimates that this taxon diverged as a separate lineage at ~1.84 million years ago (Ma). Two distinct mitochondrial lineages are revealed within the sample dividing chacmas into northeastern (~1.52Ma) and southwestern (~1.22Ma) clades and suggesting an independent history for the ruacana clade from ~0.68Ma. This pattern of diversification is linked to landscape change during the climatically variable Pleistocene. These findings are used to test further hypotheses of landscape driven population differentiation within chacma baboons. The purpose of this study is to improve our understanding of the link between past and present landscapes and genetic structuring within *Papio*. Employing phylogeographic techniques a 473bp alignment of the mitochondrial D-loop is analysed from 132 chacma baboon individuals from South Africa, Namibia, Botswana and Zambia. Here the distribution of diversity within and between modern chacma baboon populations is described and spatial structure within the dataset is investigated. We also statistically test: (1) the proposition that populations contracted into palaeo-refugia followed by expansion and possible secondary contact (2) the role of genetic drift in structuring the data set, and (3) the strength of association between haplogroups and local habitats. Results suggest that a major population divergence event within chacma baboons was followed by renewed gene flow, and further facilitated by later population expansions to current chacma distributions. The localised distribution of modern haplotypes suggest low individual dispersal distances while the geographic range of haplogroups hint that habitat specificity plays a significant role in driving contemporary population structure.

**88. Collagen fiber orientation (CFO) variations in the hominid femoral neck are likely invalid for deciphering load history when cortical robusticity is low.**

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Load history of the proximal hominid femur is central in the debate of the origins of bipedalism. This is typically inferred from structural/geometrical features of the femoral neck (FN). For example, the emergence of habitual bending across the FN is associated with arched trabecular patterns and asymmetry of cortical thickness in the plane of bending. Recent studies show that variations in predominant collagen fiber orientation (CFO) in the cortical shell are much stronger than structural features in detecting and distinguishing habitual bending from torsion. Stereotypical bipedalism is linked with bending across the FN, producing ambient tension and compression in opposing cortices. CFO data support counter-bending load history in the chimpanzee FN where lurching produces prevalent/predominant tension in the anterior-inferior aspect and compression in the superior-posterior aspect. Similar biomechanically significant CFO variations are found across the modern human FN, which are consistent with compression-adapted CFO in the superior cortex; but here counter-bending seems implausible. Paradoxical CFO data in the human FN can be reconciled by considering that: (1) cancellous-cortical bone load sharing are highly disproportionate between the

human and chimpanzee FN, (2) human FN loading is relatively more complex, and (3) the human FN cortex is so thin that load-specific regional histological adaptation (i.e., CFO and secondary osteon morphotypes) seen in the more robust chimpanzee FN is not required. It can be argued that there is a cortical robusticity threshold below which the use of histological variations are invalid in deciphering load history, which is the case in the human FN.

**Mandibular P4 morphology among Plio-Pleistocene hominins: taxonomic implications and morphological trends.**

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Simple metrical and non-metrical measures suggest that Plio-Pleistocene hominin mandibular premolar crown morphology is both taxonomically and phylogenetically informative. However, maximizing this information is complicated by the loss of original crown shape and outer enamel surface morphology due to attrition in the hypodigms of the fossil taxa. Fortunately, the enamel-dentine junction (EDJ) preserves much of the original shape of the tooth underneath the worn enamel cap. In this study we examined EDJ morphology of mandibular fourth premolars (P4) in samples of extant apes and Plio-Pleistocene hominin taxa in order to 1) assess the taxonomic distinctiveness of P4 EDJ morphology and 2) to track changes in P4 EDJ shape during hominin evolution. Premolars were subjected to micro-computed tomography (isometric voxel resolution ~30 microns) and the EDJ surface was segmented as a digital surface model. To quantify shape variation among the study taxa, a geometric morphometric analysis was conducted; placing 3D landmark coordinates around the cervix and along the marginal ridge which runs between the dentine horns of the protoconid and metaconid. Results indicate that P4 EDJ morphology discriminates reliably among hominin taxa. Taxonomically-relevant shape variation in P4 EDJ morphology includes changes to crown base shape, crown height, relative dentine horn height and positioning, and the relative size of the anterior and posterior fovea. Trends in shape variation between hominin taxa are discussed with regard to current hominin phylogenetic hypotheses.

This study was supported by the Max Planck Society and NSF-IGERT DGE-0801634 and NSF-GRFP grants.

**Integrating geometric morphometrics and finite element analysis to assess the biomechanical implications of shape variation in chimpanzee crania.**

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Finite element analysis (FEA) is a powerful tool for analyzing the biomechanical consequences of variation in shape. However, practical limitations typically preclude researchers from examining more than one or only a few individuals from any given species. This lack of knowledge concerning the mechanical significance of intraspecific shape variation limits our ability to infer the significance of interspecific differences. This study uses geometric morphometrics and FEA to examine the biomechanical implications of shape variation in chimpanzee crania, thereby providing a comparative context in which to interpret cranial variation between hominid species.

For each of 19 chimpanzees, 709 landmarks and semi-landmarks were digitized on 3D surfaces derived from CT scans. The 19 landmark configurations were converted to shape coordinates by Generalized Procrustes Analysis (GPA) and shape variability was decomposed into orthogonal components by Principal Component Analysis (PCA). FE models of the specimens lying at the extremes of the first three principal components were created from CT scans, assigned the material properties of bone, subjected to muscle forces derived from physiological cross-sectional area data, and constrained at the TMJs and bite point so as to simulate mastication. Muscle forces were scaled to remove the effect of size on strain values. Results indicate that facial projection is an important influence on feeding strains. This approach is still limited, e.g., our six specimens are too few to talk about errors and population variation in earnest. Yet, it represents a first (and practicable) step forward to estimate the spectrum of loading scenarios within a sample.

This project was funded by grants from the National Science Foundation Physical Anthropology HOMINID program (NSF BCS 0725219, 0725183, 0725147, 0725141, 0725136, 0725126, 0725122, 0725078), NSF BIO 0743460 and the EU FP6 Marie Curie Actions MRTN-CT-2005-019564 "EVAN".

**Late Epipaleolithic infant remains from Kaus Kozah Cave, southwestern Syria.**

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Kaus Kozah Cave (Damascus Province, Syria), excavated by the Tübingen-Damascus Excavation and Survey Project, yielded two infants (Kaus Kozah 1 and 2) at the top of a geological horizon (GH4) containing Middle Paleolithic artifacts. Three overlying layers consist mainly of anthropogenic deposits from the Epipaleolithic and Neolithic. Although both individuals lack grave goods, they are spatially distinct and preserved sufficiently to suggest intrusive burials into GH4. Direct AMS radiocarbon dates on KK1 provide ages of 10,485+/-50 and 10,130+/-70 BP, at the end of the Epipaleolithic (Late Natufian).

Late Natufian burials are not rare in Israel, but these are the first from this region. Kaus Kozah 1 (KK 1) is represented by 31 teeth (17 deciduous), aged at 3.5 years. Kaus Kozah 2 (KK2) preserves 20 teeth (17 deciduous) and is approximately 14-16 months of age. Each has highly fragmented cranial and postcranial remains. No indicators of pathology or stress are observable on bones, but the dentition of KK1 exhibits large planar defects (deciduous canines) and linear hypoplasia (permanent incisors). Their position places them around the time of birth. KK2 lacks these and exhibits smaller teeth, suggesting sexual dimorphism, population differences, or both.

These individuals provide a window into the variation and general conditions among the latest hunter-gatherers