dataset, we performed two sets of biodistance analyses: 1) kinship analyses were conducted to assess correspondence between biological structure and spatial cemetery organization, and 2) postmarital residence analyses were conducted to assess sex-specific within-cemetery variation. Results are discussed in reference to recently-discovered regional practices of social and biological integration, which have significant implications for the mediation of individual, kinship, and group identities during a time of rapid secondary state formation throughout the southern Levant. These findings illuminate aspects of population structure and social organization of a potentially influential (yet understudied) population and the nature of their interactions with surrounding groups during a formative period in the Middle East.

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The emergence of inequality: An analysis of fifty years of anthropometric data from Nuñoa, Peru

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Nuñoa, Peru has been the site of anthropological research on human adaptability and health since the 1960's. At this time, several large-scale anthropometric studies were conducted. Subsequent data collections have taken place in the 1980s, 1990s, and 2012-15. This temporal depth of data collection provides an unparalleled opportunity to examine changes in patterns of growth across time. Data collections serendipitously timed such that they precede and follow major social, political and economic shifts in the area including: a major agrarian land reform in 1969, the civil conflict between the *Sendero Luminoso* revolutionary movement and Peruvian military, and the flood of state and NGO sponsored development projects aimed at fostering the emerging dairy industry throughout the southern highlands. In this paper, we present results from a meta-analysis of anthropometric data from the 1960s, 80s, and 90s alongside the contemporary data. Z scores for both height-for-age and weight-for-age are re-calculated using the 2009 WHO growth standards to allow for comparability across time periods. We observe improved stature and weight between the 1960s and 1980s, almost no change between the 1980s and 1990s and statistically significant reductions in stunting between the 1990s and 2015. Recent anthropometric data reveals emergent childhood overweight and obesity as well as a trend toward greater inequality, patterned on variation in economic activity. Specifically, we find the largest improved growth in higher SES families in town, followed by families involved in dairying, with poor families in town and herding families having the highest rates of stunting.

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Women in war: A multi-isotopic analysis of females discovered in a mass grave with Napoleonic soldiers

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Women have participated actively in war for thousands of years, traveling with armies and serving a number of roles including soldier, prostitute, wife, sutler, nurse, and laundress. The campaigns of the Napoleonic Wars of the early 19th century offer abundant examples of women journeying with Napoleon's Grand Army. During the Russian Campaign of 1812, women traveled, died, and were buried with soldiers on their retreat from Moscow. A mass grave excavated in 2001 containing the remains of Napoleonic male soldiers in Vilnius, Lithuania also held the remains of female individuals. A focused analysis of three females from the mass grave provides insight into the experience of this underrepresented group in war convoys. Stable carbon, nitrogen, and oxygen isotope ratio analyses were performed on femoral collagen and apatite of these individuals to investigate variability in diet and migration of female war participants, and were compared to those of their male counterparts from the mass grave. Among females, stable nitrogen isotope ratios exhibit low variation (range of 0.5‰), whereas stable carbon isotope ratios from collagen and apatite and oxygen stable isotope ratios exhibit wider ranges (range=3.9‰ for collagen carbon, 1.29‰ for apatite carbon, and 2.06‰ for oxygen). The oxygen isotope data in particular point to different geographic origins for females accompanying the army. Such isotopic variation among females in this sample reflects the diversity of experiences of these individuals, as detected from differences in diet and movement across the European landscape.

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Body mass and femur length of *Orrorin tugenensis*

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A cast of the left proximal femur (BAR 1002'00) of the 6.0 Ma hominin species *Orrorin tugenensis* is examined to estimate the specimen's body mass and femoral length. The specimen's anteroposterior femoral head diameter (32.2 mm) is used to estimate body mass with formulae derived from modern humans, yielding an estimate of ca. 34.4 kg, close to the estimate of 35.8 kg reported by Grabowski and colleagues. We also estimate body mass using African ape formulae from Jungers and Susman and Jungers, yielding an estimate of 42.2 kg. Femoral length of the specimen was then estimated using the position of the femoral waist. As defined by Friedl, the femoral waist is the weakest point along the shaft. We find that the femoral waist of BAR 1002'00 is located 7.6 mm proximal to its preserved distal end. Using a sample of 244 humans, an OLS regression of the distance from the head to the femoral waist on femoral length yields a femoral length estimate for BAR 1002'00 of ca. 408 mm, with a 95% CI of 354 – 462 mm.

When these data are plotted in ln-linearized bivariate space, *Orrorin tugenensis* falls well above the African apes in terms of femur length to body mass, and falls near the *Homo sapiens* OLS and RMA regression lines. If *Orrorin tugenensis* is indeed a 6.0 Ma hominin, this indicates very early elongation of the lower limb associated with terrestrial bipedalism.

Why Paleoneurology Needs the Lunate Sulcus

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The infamous lunate sulcus, controversial as it is, is one of the few sulci that can sometimes be seen on ape and hominin endocasts. The position of this sulcus, whether anterior as in apes, or posterior as in hominins is of great importance, because this sulcus marks the boundary between primary visual cortex, area 17 of Brodmann, and peri- and para visual cortices (areas 18 and 19), and posterior parietal association cortex. Since endocasts can provide accurate volumes, the posterior placement of a lunate sulcus on an ape-sized hominin endocast (e.g., Taung, AL 162-28SK1584, Stw 505) indicates that brain reorganization has preceded endocranial volume increases and that these hominins had relatively expanded parietal and posterior inferior temporal lobe cortices, which are of considerable significance regarding cognitive abilities.

Recently, Falk has suggested that the landmark be discarded, while keeping the "Affenspalte" for the anthropoids. Falk also

suggests that the deep, crescentic furrow I identified as the lunate sulcus on Stw 505 is possibly a lateral calcarine sulcus. None of the lateral calcarine sulci examined on 48 ape hemispheres are ever as deep or curve in the same crescentic shape as does the lunate. Furthermore, the lateral calcarine does not appear on either ape or human endocasts, except for an occasional dimple at the occipital pole.

There is no anatomical or functional basis for discarding the lunate sulcus. Instead, it needs to be more carefully studied and its relationship to operculization and primary visual cortex better understood.

Ontogenetic shifts in the pattern and magnitude of mandibular covariance

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The structure of covariance in developing morphological structures can alter due to shifting ontogenetic and functional demands. This is important for complex morphological structures, like the primate mandible, because covariance may determine how susceptible such structures are to adaptive influences. Here we used a cross-sectional sample of laboratory mice to determine when/how the *pattern* (how traits covary) and *magnitude* (strength of trait covariance) of covariance change in the mandible. Specifically, we predicted that mandibular covariance is stable before the onset of weaning but alters after introduction of an adult diet.

Micro-CT scans were collected from a series of embryonic, peri-weaning and adult mouse skulls (n=79). Three-dimensional landmark coordinate data were collected from each mandible. Procrustes superimposition was applied to coordinate data to produce shape variables. Covariance matrices and Scaled Variance of Eigenvalues were generated from shape variables and used to compare patterns and magnitudes of covariance between age groups, respectively. Significance was determined via permutation tests.

Patterns of covariance in the mandible were different between adults and the younger mice ($p>0.05$; null of *no similarity*), but not between embryonic and peri-weaning ages ($p=0.035$; null of *no similarity*). However, observed matrix correlation values were remarkably low ($R_{obs}<0.2$) in all comparisons. Furthermore, the magnitude of trait covariance decreased markedly throughout ontogeny ($p<0.001$). Mandibular covariance structure does in fact change over growth even before dietary shifts, suggesting that other processes (i.e., somatic or dental growth) are involved. These results are important for future analyses regarding plasticity or constraint in primate mandibular evolution.

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What level of biogeographical information is available from ^{18}O and ^{13}C signatures in late-erupting molars of modern humans?

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Stable isotope analysis of biogenic tissues such as tooth enamel and bone mineral has become an increasingly important method for determining the provenance of human remains. Both ^{18}O and ^{2}H stable isotope signatures are widely used proxies as environmental indicators of climate and source water and are therefore considered reliable indicators of human geographic life trajectories. Similarly, ^{13}C abundance data have distinguished dietary preferences in ancient human populations, and have been used to qualify ambiguous ^{2}H and ^{18}O geolocational data. This study tested some of these widely held assumptions using data from tooth enamel of living individuals with known life histories.

Tooth enamel was sampled from 10 Canadian volunteers undergoing routine third molar extractions. Crown enamel was drilled, chemically cleaned, and subsequently analyzed for its ^{18}O and ^{13}C composition using IRMS.

Pooled mean enamel carbonate $\delta^{13}C_{VPDB}$ and $\delta^{18}O_{VSMOW}$ values, -10.37 ‰ and 24.39 ‰, respectively, were consistent with self-reported residential history (i.e., Ontario, Quebec) and dietary preferences (e.g., persistent C_4 plant dietary influence). However, no statistically significant correlations were evident between calculated drinking water $\delta^{18}O$ values and their corresponding modeled annual average $\delta^{18}O$ values in precipitation. Merging the isotopically homogenous Canadian dataset with geographically diverse ^{18}O data from a relevant feasibility study yielded a strong positive correlation ($R^2=0.87$) between drinking water and source water $\delta^{18}O$ values.

These findings illustrate the importance of considering isotopically complex site-specific hydrogeological processes and using multi-isotope data obtained from multiple tissues when investigating the geographic origins of humans in an archaeological or forensic context.

Functional morphology of the metatarsophalangeal joints in chimpanzees and humans: A kinematic and morphometric approach

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During bipedal walking, humans dorsiflex their metatarsophalangeal joints (MTPJs) to a high degree just prior to toe-off. This motion tightens the plantar aponeurosis, converting the foot into a strong propulsive lever. Particular features of human metatarsal (MT) head morphology (e.g., "dorsal doming") are thought to help enable this mechanism. In contrast, chimpanzees are thought to possess MT head morphology that precludes loading of the MTPJs at high dorsiflexion angles.

To test this notion, we measured MTPJ motion in 5 human and 2 chimpanzee subjects during walking using 3-D kinematic methods. We also used 3-D geometric morphometric (3DGM) techniques to quantify MT1-5 head shape in a large sample of human and chimpanzee specimens. We found that humans exhibit significantly greater peak dorsiflexion angles at all MTPJs than chimpanzees, with the greatest disparity between species occurring at MTPJ 1. Among MTPJs 2-5, both species exhibited a mediolateral gradient from higher to lower peak joint angles. These results are reflected in the morphometric data; PC1 separated chimpanzees and humans, and PC2 separated MT rays within species. PC1 was driven primarily by a dorsal versus plantar orientation of the MT head, whereas PC2 captured relative mediolateral breadth of the MT head.

This research provides the first marker-based quantification of motion differences at all five MTPJs in humans and chimpanzees, and indicates that 3DGM complements experimental approaches, making it a useful method for capturing functional signals in the MTPJs. Our results should ultimately aid reconstructions of early hominin locomotion.

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Ontogeny of nasal integration in males and females

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Potential integration between the nasal region and other non-cranial components of the respiratory system has significant implications for understanding the determinants of naso-facial variation. Indeed, broader systemic factors