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New regression equations for adult living stature estimation in a South African population group using measurements from MRI scanograms

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One of the most important steps in the identification of a person from skeletal remains is the estimation of stature. Measurements from various bones of the skeleton have been used in the formulation of regression equations for stature estimation. However, long bones of the upper and lower extremities are widely used for this purpose because of the high correlation that exist between these bones and stature. In 1987, Lundy and Feldesman presented regression equations for stature estimation for the black South African population group based on measurements of bones from the Raymond Dart Collection of Human Skeletons. The validity of these equations has been questioned by local anthropologists. In the current study, living stature measurement (LSM) and MRI scanograms of 58 volunteers (28 males and 30 females) who are members of modern black South African population group were obtained. Physiological length of the femur (FEML) and condylomalleolar length of the tibia (CMLT) were measured on each scanogram and substituted into appropriate equations of Lundy and Feldesman (1987) to obtain estimate of living stature (ELS). A comparison was made between LSM and ELS using paired t-test which showed statistically significant difference, an indication of non-validity of Lundy and Feldesman's (1987) equations. Both FEML and CMLT presented with significantly high positive correlation with LSM (0.88-0.92). New regression equations were formulated separately for males and females and the resulting standard error of estimate (2.14 – 2.58cm) compared well with those presented for other studies utilizing long limb bones.

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Hippopotamid ecology in the Turkana Basin: isotopic variation across the Pleistocene

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Today, the family Hippopotamidae is represented by two genera, *Hippopotamus* and *Hexaprotodon*. Modern representatives of these genera differ significantly from one another in terms of size,

ecology, and geographical distribution. While differences in size span back as far as the Miocene, throughout their fossil record in Africa, it is unclear whether these taxa differed ecologically. In this study, we use a large compilation of published and unpublished carbon and oxygen isotope values ($n = 90$) to investigate the ecology of *Hippopotamus* and *Hexaprotodon* at East Turkana in northern Kenya between 2.0 and 1.4 Ma to provide insights into ecosystem dynamics during this important period in hominin evolution. Our analyses of fossil hippopotamids indicates significant spatial differences in carbon isotope signature, but relatively little change through time. We also find no significant difference in carbon isotope signature between the *Hippopotamus* and *Hexaprotodon* during this period. Hippopotamid oxygen isotopic data are particularly useful for insights into basin hydrology in the region. We find no significant difference in hippopotamid oxygen isotope signature across temporal or geographic boundaries. We also find no significant differences between the *Hippopotamus* and *Hexaprotodon* lineages during this period. Our findings suggest that 1) hippopotamid diet and ecology do not track well-documented landscape alterations during this period in East Turkana and 2) the *Hippopotamus* and *Hexaprotodon* lineages had overlapping isotopic niches during this period. The latter finding should be further addressed with more highly resolved dietary analyses (e.g., seasonality, $\Delta^{17}\text{O}$).

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Genomic Adaptation to High Altitude Among Peruvian Quechua

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Over the course of some 11,000 years, humans have colonized the Andean Altiplano (Plateau), which boasts an average height of 12,000 feet (3,700 m). At this altitude, oxygen concentration is only 65% of that at sea level, yet Andeans have flourished under these harsh environmental conditions. To refine our understanding of the Andean pattern of high-altitude adaptation, we recruited four study groups with varying developmental exposures to high altitude: 1) Quechua born and raised at high altitude, 2) Quechua born and raised at low altitude, 3) Quechua low-altitude down migrants, and 4) Low-altitude participants of European ancestry.

Pulmonary and hematological phenotype data were collected at the time of enrollment. SNP genotype data were generated using the Affymetrix Biobanking Array. From these data, we identified several selection nominated candidate gene regions for high-altitude adaptation including genes that are part of the hypoxia inducible transcription factor (HIF) pathway as well as other genomic regions. We then tested polymorphisms in a single high-altitude adaptive gene, *EGLN1*, for associations with VO_2Max and hemoglobin concentration. We identified SNP variation in *EGLN1* that affects the capacity for oxygen transport and/or oxygen uptake during aerobic exercise. Furthermore, contrary to findings among Tibetans, we did not identify *EGLN1* SNPs contributing to hemoglobin concentration in Andeans. Together, our results provide critical insights into the genetic mechanisms underlying the Andean pattern of adaptation to high altitude and help refine the Tibetan and Andean contrast.

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Spatial Parameters Influence the Distribution of Orangutan (*Pongo pygmaeus wurmbii*) Dispersed Seeds

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Animal-mediated seed dispersal is important for promoting forest regeneration and sustainability. Animal movement influences the distribution of seeds across the environment, resulting in spatially aggregated seed dispersal patterns. Animal seed dispersal patterns likely play an important role in the spatial structuring of tree populations: where a seed disperser moves influences the seed distribution. Environmental parameters that shape a disperser's movement also influence the spatial distribution pattern of their seed dispersal. Orangutans are highly frugivorous and have been shown to disperse intact viable seeds. GPS locations were recorded for all orangutan defecations ($n=1721$) from 2014 to 2016 at the Cabang Panti Research Station in Gunung Palung National Park (GPNP), Indonesia. Our pilot research at GPNP measured seeds in fecal samples ($n=98$ fecal samples) and demonstrated that orangutan fecal samples do have intact seeds in more than 95% of their feces. A kernel density map was made using the defecation data to calculate the spatial density distribution of the defecations. A geographically weighted regression model (GWR) analyzed how well spatial parameters (altitude, slope, distance to river, and normalized difference vegetation index) predict the spatial density distribution of orangutan seed dispersal. All parameters in the GWR were statistically significant ($R^2=0.80$,

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$p < 0.001$) and showed low values for collinearity. The results show that orangutan seed dispersal is aggregated in space and the seed dispersal pattern is significantly shaped by environmental variables. This study provides us a better understanding of how the environment plays a role in determining animal behavior which influences the seed spatial distribution.

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To arouse or not to arouse: physiological responses from active thermogenesis versus thermoconforming in hibernating dwarf lemurs

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Madagascar's dwarf lemurs (genus *Cheirogaleus*) use hibernation obligatorily as a metabolic strategy to save energy. Under cold conditions, dwarf lemurs undergo torpor bouts interspersed with periods of thermogenically-induced arousals, during which they become euthermic. However, under hot conditions, dwarf lemurs can achieve euthermia passively. These transitory bouts of euthermia during torpor enable critical physiological processes that require high body temperature. To better understand the links between hibernation, temperature, and physiology, we compare dwarf lemurs hibernating under different conditions: (a) dry-forest dwarf lemurs at Kirindy "thermoconforming" in poorly-insulated tree holes, achieving euthermia passively by tracking daily fluctuations in ambient temperature, (b) high-plateau dwarf lemurs at Tsinjoarivo, hibernating underground at consistently low body temperatures, achieving euthermia using active thermogenesis during arousals; (c) a dwarf lemur hibernating at Tsihomanaomby, in a "warm" environment similar to Kirindy, but undergoing active thermogenesis as do lemurs from Tsinjoarivo. When body temperatures exceeded 30 °C, EEG recordings indicate that dwarf lemurs under all three conditions exhibit brain activity consistent with alterations between REM and non-REM sleep. As expected, the Tsihomanaomby dwarf lemur, who underwent thermogenesis under warm conditions, achieved euthermia and reached the maximum heart rate sooner than the others. Nevertheless, the magnitude of heart rate (~200 bpm) remained intermediate between Kirindy and Tsinjoarivo dwarf lemurs (~120 and 300 bpm) respectively. It is unknown if the magnitude and rate of physiological changes resulting from thermogenesis vs. thermocomforming under different environmental conditions pose

health risks, or whether they safely allow dwarf lemurs to cope with ecological heterogeneity.

Influence of Female Reproductive State on Social Network Structure in White-bellied Spider Monkeys (*Ateles belzebuth*)

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According to primate socioecological models, females distribute themselves in their environments according to the distribution of food resources, while males' sociospatial behavior is driven primarily by the distribution of fertile females. Among spider monkeys living in fission-fusion societies, fertile females are spatiotemporally dispersed, as females commonly travel alone or in small subgroups and females are only sexually receptive for a short period every few years. The presence of sexually receptive females should therefore have a pronounced effect on spatial association patterns within groups. We used social network analysis to examine differences in spider monkey association patterns in Amazonian Ecuador over two periods in 2011-2012, one in which no conceptive females were present and one in which ~1/3 of adult females were sexually receptive. We extracted data on subgroup association patterns for these two periods and constructed social networks for 13 adult individuals (8 females, 6 males) for which we had focal samples during each month of the relevant periods. Male-female dyads had significantly stronger associations when conceptive females were present, but male-male association patterns did not differ across the two periods. For the first period, with no conceptive females, females had lower social network strength and eigenvector centrality than males, but there were no sex differences in these network measures for the second period. Our results demonstrate some of the ways in which social network analysis can reveal changes in spatial association structure associated with variation in female reproductive state in a species characterized by fission-fusion dynamics.

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Somebody call a doctor!: Identifying limitations in using clinical data to interpret health in human skeletal remains from a Post-Medieval English cemetery

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Skeletal indicators of interrupted growth and development have long been used to identify general health in past populations. However, using advances in clinical knowledge, correlated with skeletal evidence for early life health problems, can help bioarchaeological studies potentially identify health conditions in the past that can be found today. This contextually driven study considers the identification of indicators of child and later adult health (non-communicable diseases) in an archaeological population in relation to the theories proposed by the Developmental Origins of Health and Disease hypothesis (DOHaD). The study focuses on skeletons of a Quaker community dated from the 18th to 19th centuries, excavated from the Coach Lane cemetery in North Shields, England. A sample of 54 adults able to be identified for age and sex were analyzed (23 females and 31 males). Results from the skeletal data did not reveal strong evidence of the DOHaD hypothesis in showing the comparison between past clinical health conditions and modern clinical health conditions due to missing records documenting cause of death. However, the skeletal data suggests that the Coach Lane community experienced health hardships typical for individuals living in an industrial city during this period. The significance of this study highlights where further research is needed in linking early child health indicators in skeletal remains with non-communicable diseases in later adult life. In particular, while this is a development from previous work addressing the DOHaD hypothesis using archaeological human remains, it is not without its challenges in interpretation.

Helton Mound 22 Crematory: An Examination of Late Woodland Mortuary Practices

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The Late Woodland period in the Lower Illinois River Valley is characterized as a time of immense social change, as reflected by the diversity of mortuary practices. Mortuary practices of Late Woodland people are not as well-known as those of the Middle Woodland, in part due to the decline in numbers of burial accompaniments, which make the time period more difficult to study. Holistic understandings of the regional mortuary program are further constrained by the time-intensive process required to examine fragile cremated remains, resulting in cremations being understudied relative to other mortuary treatments.