Abstracts of AAPA Poster and Podium Presentations

Mitochondrial DNA analysis of the Jomon and Epi-Jomon individuals in Hokkaido, Japan.

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From the morphological point of view, prehistoric populations in Hokkaido are considered to have been least influenced by Yayoi immigrants. Therefore, genetic study of these people can be expected to provide important information on the genealogy of the early settlers of the Japanese archipelago. In the present study, we examined the genealogy of the seventy-six Jomon and Epi-Jomon skeletons excavated in Hokkaido, Japan by mitochondiral DNA analysis.

To identify their genealogy securely, we analyzed the coding region of mtDNA by using amplified product-length polymorphisms (Umetsu et al., 2001, 2005) and direct sequencing. We also sequenced the segments of two hypervariable regions of mtDNA, and assigned the mtDNA under study to relevant haplogroups using the known mtDNA databases.

Haplogroups D4, G1, M7a, and N9b were observed in the individuals, and N9b was by far the most predominant. The frequencies of the haplogroups were quite different from any modern populations including Ainu and Okinawans. Haplogroup N9b is hitherto observed almost only in Japanese populations; therefore, this haplogroup might be the (pre-) Jomon contribution to the modern Japanese mtDNA pool.

Taphonomy of the GD 2 *in situ* deposits at Gondolin, North West Province, South Africa.

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Fossiliferous *in situ* breccias from Gondolin GD 2 were originally excavated in 1979. Preliminary taphonomic analysis of part of the faunal assemblage suggested that the fossil deposits were accumulated by felids that were possibly using this portion of the cave system as a den site. While this reconstruction implied a similar taphonomic history for the assemblage to the other South African Plio-Pleistocene karstic deposits, GD 2 contrasts these other contemporaneous assemblages in its lack of recovered hominin and other primate specimens. Recent comprehensive reanalysis of the GD 2 assemblage has considered taphonomic aspects of the entire sample. Faunal representation, skeletal element abundance and patterns of pre- and post-depositional modification to remains in the GD 2 assemblage confirm aspects of the original taphonomic reconstruction. When combined with geological data on the original cave system, it appears that the GD 2 deposits were accumulated over a rapid period of time by a predator, likely a felid, which brought nearly complete carcasses into the deposits via a large, lateral entrance. This reanalysis has also revealed strong contrasts between the GD 2 faunal assemblage and the other South African Plio-Pleistocene karstic deposits in several aspects of its taphonomy beyond faunal representation. The summed results of intersite comparisons suggest that the incorporation of hominin and other primate remains into South African karstic deposits during the Plio-Pleistocene were mediated by a series of factors including predator activity, aspects of cave morphology, and the extent to which primates made use of specific cave entrances and systems.

Rightward volumetric asymmetry in the motor hand region of the brain in right- and left-handers.

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The motor hand region of the brain (the "hand knob") is located in the superior part of the precentral gyrus (Yousry et al. 1997). In great apes, the left hand knob is larger than the right (Hopkins and Pilcher 2001); handedness may be associated with asymmetries in the hand knob favoring the contralateral side (Hopkins and Cantalupo 2004). Hand knob volumetric asymmetries in humans have not been examined. Although structural asymmetries associated with functional laterality may be expected in this part of the brain, non-volumetric investigations (VBM) of asymmetries in the hand knob region have not provided consistent results.

We used high-resolution MRI to measure hand knob gray and white matter volume (GM, WM) in 25 right-handers (14 F, 11 M, avg. age 28.5) and 23 left-handers (15 F, 8 M, avg. age 36.2). Hand knobs were manually traced on contiguous axial slices (1mm thick), after identification of landmarks following Yousry et al. Volumes of the frontal lobes and precentral gyrus were also determined.

Asymmetry scores indicate that WM volume in males and females regardless of handedness is strongly rightwardly asymmetric. In males only (either handedness), GM volume is also larger on the right. Preliminary results of the precentral gyrus indicate that that structure is symmetric in right-handers, thus rightward asymmetry may be limited to the motor hand area.

These results indicate that there has been a reorganization of the motor hand area during hominid evolution. How this structural asymmetry relates to the evolution of handedness remains to be determined.

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Analysis of the human skeletal remains from the Fate Bell Shelter (41VV74).

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Fate Bell Shelter (41VV74) is a rock shelter within Seminole Canyon, located in the Lower Pecos archeological region of Texas. The shelter contained artifacts, elaborate rock art and burials that indicate an occupation of over 8,000 years, from the Middle Archaic (5500-3200 BP) to the Late Prehistoric Period (1320-450 BP). University of Texas archaeologists carried out the first major excavation of the shelter in 1932. The site report indicates that eight burials were uncovered, three of which had no skeletal remains, while the remaining burials were comprised of two infant burials, one child burial, one adult burial, and one group burial containing four adult skeletons and scattered subadult remains (Pearce and Jackson, 1933). Associated artifacts suggest human skeletal remains at the site date to the Middle through the Late Archaic period (5500-1300 BP).

Analyses revealed that a total of 13 individuals were represented among the eight burials reported, including five adults, one adolescent, four children, and three infants. Of the five adults and one adolescent present, four females, one male and one individual of indeterminate sex

are represented. The results of analyses of general pathology and oral health on both adults and subadults are examined and provide a biological profile of the individuals at the site. A comparative analysis of the Fate Bell Shelter to other mortuary sites in the Lower Pecos region is also presented and provides insight into the health and mortuary practices of individuals living in the region during the Archaic period.

Species and varieties of early *Homo*.

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The fossil record of early *Homo*, commonly assigned to *H. habilis* and *H. erectus*, is scant, widely dispersed, and the subject of taxonomic arguments. Whether we recognize more than eight or only one species is predicated on paradigmatic differences in how to recognize species in the fossil record. The undertaking is fraught with two issues; the inadequacy of these fossil samples to address levels of population variation, and the more intractable issue of how best to view living species and project them into the past. As our appreciation of the influences of size and scale on morphological characters increases with larger samples – the definitive distinctions between many proposed groups blur. I present evidence of some level of isolation in certain regions – certainly in northern China, perhaps in island Southeast Asia, and Georgia. However, isolation is difficult to argue for either East or South Africa. And the level of isolation implied by the morphology is not as extreme as for western Neandertals whose specific status is contested.

Evidence from the extant world argues that we might come at the question from another direction rather than focusing on the names assigned. If we view the morphological evidence in light of the ecological contexts in which these hominins lived and we glean from this some understanding of the local adaptations relevant to their evolution, their degree of isolation, and how quickly it arose, we are indeed addressing the same question of biological interest to taxonomists, although we may call it by another name.

Sexual swelling relative to occurrence and timing of ovulation in *Papio sp.*

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Sexual swelling is used to infer ovulation in wild female baboons. Previous studies reported conflicting results on the relationship between turgescence and timing of ovulation in captive populations. Reliability of predicting ovulation in wild animals subjected to various natural stressors has not been tested. Moreover, previous research has investigated only ovulatory cycles and not addressed the predictability of ovulation. This study explores the predictability of the timing and occurrence of ovulation in relation to turgescence within a stressful situation in captive *Papio sp*.

Twenty female baboons were transferred from group enclosures to individual cages. They were monitored daily for four months for turgescence, menstrual bleeds and urinary FSH, estrone conjugates and pregnanediol-3-glucuronide. The occurrence and timing of ovulation were estimated hormonally using modifications of published algorithms.

Of 81 cycles studied, 64 were neither right nor left censored. Results reveal no significant effect of the stress of isolation. Ovulation occurred in 80/81 cycles with a mean day of ovulation of 15.09 (range=8-30). Relative to turgescence 76% of ovulations occurred from one to five days prior to deturgescence, and 15% occurred outside maximal turgescence. One ovulation occurred in the absence of turgescence, but within a normal hormonal cycle, and the single hormonally anovulatory cycle occurred within a normal swelling cycle. The results suggest turgescence is an imperfect indicator of the timing and occurrence of ovulation. Hormonal evaluation can improve the quality and quantity of data for research on reproductive biology and ecology in *Papio sp*.

Species resilience in *Homo*: An analogy to the wolf-like canids.

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Neither morphological nor genetic analyses have definitively resolved the question of whether more than one species of *Homo* existed contemporaneously in the Pleistocene. This is largely because the taxonomic significance of morphological and genetic differences between closely similar animals is unclear. This paper uses an analogy to the wolf-like canids to ask the question, How many *Homo* species should there be, given their likely behavioral profile(s)? In contrast to earlier comparisons to social carnivores which sought to illuminate hominid behavioral ecology, this paper explores constraints on the process of speciation itself. Wolves and coyotes are similar to Pleistocene hominids in three key ways: (1) they are adapted for endurance locomotion, (2) they are flesh eaters, but can meet their subsistence needs in a variety of ways, and (3) they are socially flexible. As a consequence of these behavioral parallels, the evolutionary history of the wolf-like canids can be used to infer the probable evolutionary effect of two defining aspects of Pleistocene *Homo*: (1) their relative habitat tolerance, predicted from evidence of their dietary breadth, technical sophistication, and social plasticity; and (2) their high mobility, predicted from morphological indicators of a capacity for endurance locomotion. The analogy suggests that Pleistocene *Homo* would not have had the opportunity to speciate, especially in Africa. Unlike an earlier single-species hypothesis based on the Competitive Exclusion Principle, this analysis examines constraints on the speciation process itself among allopatric populations, rather than attempting to specify niche relationships between sympatric species.

Sequence variation in mtDNA hypervariable segment 1 indicates within haplogroup continuity between contemporary and prehistoric Aleut populations.

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It has been demonstrated, through the use of discrete marker analysis, that both contemporary and ancient Aleut populations are distinctive relative to other arctic and sub-arctic populations due to their high frequency of mitochondrial DNA haplogroup D. This haplogroup is rarely observed in other populations in northern North America. Contemporary Aleut populations are predominantly D_2, a subtype that is uncommonly observed in more southerly populations that harbor haplogroup D_1.

Sequencing of 355 bp of the hypervariable segment I (HVSI) in the mitochondrial genome has been undertaken on ancient Aleut samples previously identified by discrete marker analysis as haplogroup D in order to further elucidate the relationship between contemporary and ancient Aleut populations. Haplogroup D is characterized by the transition 16129G→A, while the D_2 subtype is defined by the following single nucleotide polymorphisms: 16223C→T, 16271T→C, and 16362T→C. Of these polymorphisms, 16129A and 16271C uniformly occurred in contemporary Aleut populations. Although the sample size of ancient samples analyzed to date (n=5) is small, sequences do confirm haplogroup D continuity between prehistoric and modern Aleuts. Ancient Aleuts belong to the subtype D_2 and are characterized by the same recurrent polymorphisms (16129A and 16271C) observed in modern Aleuts. This is consistent with lineage continuity for haplogroup D from its earliest observation in

the archaeological record to the present in the Aleutians.

Sequence analysis of haplogroup A individuals, characterizing the most ancient of the prehistoric Aleut individuals, complement the analysis of haplogroup D and are ongoing.

Relatedness of Eurasian and American Far Northern populations to the Amerindians: HLA genes and linguistics.

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The tripartite theory for the peopling of the Americas is supported by this study of approximately 15,000 HLA chromosomes from a worldwide sample. On the basis of the HLA system, it is remarkable that Meso- and South American Amerindians appear to be more closely related to Siberian populations but differ significantly from the Athabaskans and Eskimo-Aleuts. The Aleuts exhibit a high frequency HLA-DRB1* 0401 and *1402. Both subtypes are absent in neighboring Athabascans or in any other North American First Native populations. A similar pattern is observed for HLA-A* 02 subtypes with * 0206 being frequent in Aleuts but infrequent or absent in other North American populations. The most common extended HLA haplotype in Aleuts, HLA-A* 2402-B* 4002 – DRB1*1402 and DQB1*0301, was absent in ancient North Americans. This study assesses the relationship of genetics and languages of Far Northern European groups and evaluates their potential role in the peopling of the Americas. It is unexpected that our genetic HLA data clusters Andean populations with South Asians, raising questions concerning the reliability and consistency of specific markers in the reconstruction of human evolution. NaDene and Caucasian language groups may have formed an earlier substratum on which other more recent languages evolved in Eurasia and the Americas. The unique frequencies of the HLA haplotypes support the mtDNA sequence-based reconstruction of the phylogenetic position of the Aleuts vis a vis other populations of the Circumpolar region of the world.

Testing clambering, climbing, and leaping: Positional behavior definitions in relation to support use and canopy height.

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Definitions used in primate positional behavior research vary across studies. For example, clambering may be subsumed into other behaviors (i.e., quadrupedalism or climbing) by some authors, or considered unique by others. Leaping also has a general definition, but different characteristics exist in relation to direction and distance. Comparisons of these behavioral modes are made against canopy height and support features to test the discrimination of these behaviors.

I collected data on three species (*Cercopithecus ascanius*, *Lophocebus albigena*, and *Piliocolobus rufomitratus*) at the Ngogo Research Area, Kibale Forest National Park, Uganda in 2001 and 2003. Results indicate that support characteristics provide better discrimination among positional behavior frequencies than canopy height. *L. albigena* was most similar to *C. ascanius* in locomotion and canopy use, but comparable to *P. rufomitratus* in postural frequencies. *L. albigena* positional behavior and support use frequencies suggest that feeding ecology is a stronger indicator of preferences than body size alone. *P. rufomitratus* differed significantly from other taxa, using leaping and large supports most often.

Clambering frequencies decreased in association with quadrupedalism and climbing frequencies, and differed from these behaviors in support use characteristics, indicating unique status. Leap distance significantly affected support use patterns in all taxa, with leaps over three body lengths using more small, pliant branches than shorter leaps. These results suggest that detailed definitions identify subtle but important variation in primate positional behavior and support use.

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Skeletal Robusticity and Economies of the Ancient Arican Populations in northern Chile.

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This paper examines potential differences in skeletal robusticity of prehistoric groups from Arica, northern Chile. Measurements for a sample of 165 females and 111 males test the hypothesis that unequal subsistence-related activities among intensive agriculturalists cause a decrease in height and robusticity, compared to fishing and gathering populations. The sample comprises early Chinchorro fishers (3000-2000 B.C.) to late agriculturalists (1200 A.D.).

Female humeri length average 27.6 cm and do not show statistical differences through time and type of economy. However, male fishermen have statistically longer humeri than agriculturalists (30.5 versus 29.7 cm). Male and female tibial and femoral lengths do not change over time. Female tibias average 33 cm and males 35 cm. Female femora average 39 and males 41 cm. Females are shorter than males (150 versus 160 cm) overall.

Chinchorro females have similar midshaft humeral diameters versus agriculturalists, 19 and 18 mm, AP and ML respectively. Fishermen, however, are more robust than agriculturalists. Their humeral AP and ML diameters are 20.8 versus 19.5 mm and 21.4 versus 19.8 mm. Male and female femoral robusticity and midshaft diameters remained steady over time. Female femoral diameters are 25 and 23.5 mm AP and ML respectively. Male femoral diameters are 28 and 25 mm, AP and ML respectively. In brief, humeri are more sensitive to environmental stresses, showing a reduction of robusticity over time. Stronger arms among fishermen could be a consequence of flexion and extension during harpoon throwing. Social inequalities likely produce a greater range of stature in later populations.

Coping with habitat disturbance: Activity patterns of Milne-Edwards' sifakas in Ranomafana National Park, Madagascar.

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Given the fixed length of the day and the minimum energy requirements that animals must meet to survive, habitat disturbance may lead to alterations in how animals budget their time. When an animal engages in one activity, it incurs an opportunity cost; as it can not engage in other activities critical to its survival or reproductive success. This makes it important for us to understand the relationship between habitat disturbance and primate behavior. Taken from over 3,375 hours of continuous focal group follows, this study compares the activity budgets of individually identifiable *Propithecus edwardsi* living in disturbed and undisturbed forest environments. Analyses reveal no significant difference in the annual activity patterns of social groups *within* either the primary (n=3) or disturbed (n=4) forest site. Thus, we are able compare the annual activity patterns of groups *between* the sites. Results indicate that habitat disturbance significantly decreases the proportion of time that sifakas spend interacting socially, while increasing the time spent feeding and self-

grooming. We propose that this decrease in social time may be attributed to the increased amount of time that the disturbed forest sifakas must spend feeding/foraging (due to lower quality resources) and self-grooming (due to higher parasite loads). Ultimately, such a decrease in social activity may lead to a reduction in group cohesion, predator detection, and decreased survival within the disturbed forest. For an endangered species, such consequences could prove catastrophic.

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A new reconstruction of Pelvis 1 (*Homo heidelbergensis*) from the Sima de los Huesos (Atapuerca).

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The Middle Pleistocene site of the Sima de los Huesos (SH) in the Sierra de Atapuerca has yielded the most complete pelvis (Pelvis 1) of the human fossil record, probably of an adult male. A reconstruction of this specimen based on dry bones has been published previously. Here we reconsider some anatomical aspects, reconstruct some distorted regions, and include estimations of the soft tissue of the sacro-iliac joint and the pubic symphysis. In reconstructing the entire pelvis, four main issues have been addressed: the articulation between the sacrum and both innominate bones, the positioning of the pubis and symphyseal surface and the reconstruction of the unpreserved bony portions of the sacrum and the innominate bones.

To deal with these issues, the new reconstruction has addressed concerns such as: the angle of the iliopectineal line, transversal acetabular diameter, anatomy of the sacroiliac joint, morphology of the obstetric canal, length and morphology of the ischiopubic ramus and position of the pubic symphysis. The reconstruction is made of high-quality casts of the original specimen and is based on CT scans and direct measurements and anatomical observations of the original fossil. We have also consulted the remaining pelvic specimens from the Sima de los Huesos and the original Neandertal pelvis Kebara 2. Finally, the symmetry and anatomy of the modern human pelvis and mirror-imaging have also been considered. The resulting measurements are discussed in the context of Neandertal pelvic evolution, with particular attention paid to the geometry of the birth canal.

A decade of controversy over the teaching of evolution in the United States: a print media analysis.

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Eighty years have passed since the Scopes Monkey Trial, yet the teaching of evolution in the United States and the general public's acceptance of the tenets of Darwinian evolution are still being challenged. Recent events covered in print media have refocused attention on the evolution versus creationism controversy in the United States.

The first purpose of this study was to determine if there has been an actual increase in the frequency of media coverage of the evolution - creation controversy and to quantify trends in coverage over the last ten years. Secondly, I wanted to investigate if there were regional differences in coverage and to identify regional themes in how this debate is framed and presented.

Using LexisNexis I conducted a print media search of twenty prominent urban newspapers from four geographic regions in the United States (Northeast, Southeast, Midwest, and Western). Inserting the keywords 'teaching evolution,' 'intelligent design,' and 'creationism' yielded approximately 1000 items all printed within the last decade. Frequency analysis confirms that a spike in coverage did occur in 2005. Over the last ten years this has not been a linear increase. In 1998 and 2003 very sparse coverage occurred.

Over the last decade, newspapers from the Northeast contained the greatest number of relevant publications. The Southeast and Midwest demonstrated intermediate frequencies with the least amount of coverage coming from the West. Overall, the content in these articles reflect the increasing popularity of intelligent design and growing opposition to the teaching of evolution.

One of these is not like the other? Skeletal variation in western Alaska Native Americans, climate, and population history.

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Controversy surrounds the origins and relationships of New World and Beringian Arctic peoples. Much research has focused on central and western native Alaskan affinities to groups on both sides of the Bering Strait. Analyses using multiple data sources (e.g., Ousley, 1995) have provisionally resolved these populations' relationships. However, cranial and post-cranial morphological covariation has not been comprehensively documented among them or with exogenous factors (e.g., climate). Purported morphological relationships could be confounded by shared environment.

This study examines cranial and post-cranial variation among pre- and proto-historic Alaskan natives in relation to climatic factors and proposed affinities. 100 cranial and post-cranial osteometric measurements were obtained from 270 skeletons representing five groups: Unangan, Ikogmiut, Inupiaq, Birnirk Culture, and Tigara. 90 Wintun and Hawikuh skeletons provided comparative groups. The osteometrics were analyzed using non-parametric and multivariate parametric tests on basic measurements and derived morphological indices (e.g., intra-limb indices). NOAA climatological databases provided temperature and precipitation data.

No Arctic populations significantly differed in facial or crural indices, though all five significantly differed from the two comparative groups ($p<0.01$). Contrastingly, significant differences exist among Arctic populations in cephalic, nasal, and brachial indices, as well as relative sitting heights and estimated body mass ($p<0.05$), with the Unangan and Birnirk populations clustering apart from the other Arctic groups. The morphologies have significant but generally small correlations with climate ($r \leq 0.20$), except for intralimb indices ($r>0.60$). Shared climate is therefore interpreted to differentially affect these morphologies in relation to effects of common ancestry, gene flow or other environmental factors.

Ethics, ethnicity and genetic structure in southeastern Kenya: implications for the assignment of African-Americans to African ethnic groups.

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As genetic ancestry testing becomes increasingly more popular, care must be taken to avoid inadvertently reinforcing public misconceptions concerning race and ethnic identity. Members of the general public often perceive ethnic groups to be static and unchanging and view human genetic variation as something that is easily divided into orderly, non-overlapping ethnic or racial packages. Our recent study of two large ethnic groups from southeastern Kenya, the Taita and Mijikenda, will serve to highlight some of the difficulties inherent in using genetic ancestry testing to assign African-Americans to African ethnic groups.

Modern Taita and Mijikenda ethnic identities emerged in the early twentieth century in response to pressure on area groups to form units that fit British notions of "African tribes" and were more easily administered by the colonial government. Groups of people with no prior sense of shared identity were clustered together, with "chiefs" appointed to replace local councils of tribal elders. Consequently, shared origin myths and languages cross-cut ethnic boundaries in place today. Trading patterns and intermarriage among these groups and their neighbors have also influenced regional genetic patterns. The fluidity of conceptions of ethnicity in this area is common in many parts of Africa and has been reported by many social anthropologists and historians. The complexity of genetic patterning observed in this region suggests that individuals who expect to be provided with an exact "genetic match" with their ancestral ethnic group based on a DNA sample are likely to learn that this is not possible.

Population density and genetic diversity of the black-and-white ruffed lemur (*Varecia variegata*) in Mangevo, Madagascar.

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The critically endangered black-and-white ruffed lemur (*Varecia variegata*) is considered among Madagascar's top conservation priorities. Despite a widespread range throughout the country's eastern rainforests, prior population estimates indicate that densities are typically low, and the species cannot be considered common anywhere in its range. Increasingly fragmented habitats threaten the species with reproductive isolation, reducing genetic diversity and therefore increasing the risk of disease and reduced reproductive fitness as effective population sizes decrease. Long-term *Varecia* studies are few and rarely include genetic analyses. Therefore, further research on the population densities and genetic relatedness of the species is necessary to effectively ensure its tenure.

This study provides preliminary results from a newly established site, Mangevo (S21°22'49.8", E047°26'88.3"), located near the southeastern most peripheral zones of Ranomafana National Park (RNP). Annual censuses were conducted from April 2004 to 2005. Two-kilometer transects were surveyed twice daily, resulting in a total distance surveyed of over 120 km. Results suggest unusually high *V. variegata* densities (24.31 ind/km^2) with group sizes ranging from three to seven individuals. Additionally, a total of N = 22 individuals comprising two RNP subpopulations (Mangevo, N = 12; Vatoharanana, N = 10) were immobilized and blood and tissue samples were collected. Heterozygosity levels were analyzed and tested for Hardy Weinberg equilibria within and between populations using 20 species-specific polymorphic nuclear microsatellite loci. Results from this research will serve as baseline data for studying the relationships between genetic relatedness and the sociality and infant-care strategies of *V. variegata*.

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Who made the early Aurignacian? Evidence from isolated teeth.

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Neandertals and anatomically modern humans overlapped in Europe between 45- and 30,000 BP. Unfortunately, the human fossil record during this important time period is sparse. What is preserved is fragmentary and consists primarily of jaws and isolated teeth. This has led some to question whether we can determine if Neandertals or anatomically modern humans were responsible for the early Aurignacian. The goals of this study were, first, to investigate whether root lengths can help differentiate these two taxa; and second, to combine these data with tooth crown traits to assess the taxonomic affiliation of isolated teeth from two early Aurignacian sites (Brassempouy and La Ferrassie).

Root lengths were measured from the lingual aspect of permanent teeth of Neandertals (maximum n=15) and Upper Paleolithic modern humans (maximum n=10). The student's t-test showed that the mean root lengths of I^1, I^2, C', I_1, I_2, C, P_3, P_4 and M_2 were significantly longer in Neandertals than in Upper Paleolithic moderns ($p<0.05$), with no overlap in the ranges of I^1, I_1, C', and P^4. At Brassempouy, the root lengths of the two I^1s, C' and M^2 fall more than three standard deviations below the Neandertal mean. Likewise, the single I^1 from Le Ferrassie possesses a root that is too short to be considered Neandertal. Additionally, the tooth crowns at both Brassempouy and La Ferrassie lack any diagnostically Neandertal traits. Thus, the preponderance of dental evidence suggests that anatomically modern humans, not Neandertals, are associated with these early Aurignacian sites.

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Calories or oxygen? Skeletal growth tradeoffs at high altitude.

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Recent adaptive models specify metabolic tradeoffs between hypoxia and energy utilization. Variation in children's limb proportion at high altitude may provide a useful test of such models. We have shown previously that hypoxia targets distal leg growth. Others have argued that size reduction at high altitude is nutritionally mediated. We tested the relative contributions of caloric status and hypoxia to skeletal segment growth, using MANOVA designs corrected for age. Tibetan and Han children aged 8 through 11 living at 3100 m, 3650 m, and 3830 m were analyzed. Caloric status was measured by percent body fat, skinfolds, arm muscle area, and BMI. Hypoxia was measured by pulse oximetry, FVC, and blood pressure. Only hypoxia impacted distal limb length or internal limb proportions, while only caloric status affected sitting height and arm length. In two samples, hypoxic and caloric status independently effected height, chest circumference, and leg length. Ethnicity had marginal effects, and sex, none. We conclude that in the prepubescent skeleton, distal limb segments, especially the tibia, react primarily to hypoxia, while proximal segments and the trunk more reflect caloric status. This pattern of intra-skeleton variation is consistent with Lampl's prenatal metabolic model involving Hypoxia-Inducing Factor (HIF-1) protein. At an anthropometric level, the study of decanalization may yield richer adaptive insights if we implicate multiple stressors at segmental growth sites. At a theoretical level, these findings are compatible with selective models in which individuals with longer lower limbs will be reproductively favored.

From Matthews to Merbs: Bioarchaeology in southern Arizona.

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Bioarchaeology in the American Southwest has focused primarily upon ancestral Pueblo populations of the Four Corners region. Despite early attention to the Hohokam by the Hemenway Expedition in the 1890s, little work was subsequently conducted among the groups in southern Arizona until Charles Merbs refocused attention on these neglected populations.

Since he joined the faculty of Arizona State University (ASU) in 1973, Merbs has authored or coauthored 16 articles and book chapters on Southwestern skeletal samples and coedited an influential volume on *Health and Disease in the Prehistoric Southwest*. His reports include analysis of both cremations and inhumations, encouraging interest in studies of the former. Contributions to paleopathology in the southern Southwest range from recognition of coccidioidomycosis in the skeleton to scalping and, of course, congenital conditions of the spine.

Compliance with federal and state laws has been the catalyst for considerable fieldwork in southern Arizona in the past three decades. Charles Merbs' stimulus to new research on skeletal samples in this region has promoted an increased understanding of life and death within Hohokam, Sinagua, and Prescott societies. Knowledge of disease, trauma, relatedness, and mortuary practices has expanded due to the research of Merbs, other ASU faculty, and their students. Bioarchaeology in southern Arizona, emphasizing recent investigations at Pueblo Grande and other Hohokam sites, the Sinagua site of Nuvakwewtaqa (Chavez Pass), and sites in the Prescott area, is summarized within this framework.

Skeletal trauma analysis of the Mexican War dead from the battle of Resaca de la Palma

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The Battle of Resaca de la Palma, the second battle of the United States-Mexico War, was fought on May 9, 1846 near an abandoned bed of the Rio Grande in present day Brownsville, Texas. The battle was decisively won by U.S. troops and resulted in the death and injury of hundreds of Mexican soldiers. The following day, U.S. military personnel buried the dead Mexican soldiers in several mass graves. One of the mass graves containing the skeletal remains of at least 30 young to middle aged adult individuals, including three or more females, was discovered in 1967 and excavated by archaeologists at the University of Texas-Austin. In this paper, we present observations of battlefield injuries and physical stress indicators among the Mexican war dead and discusses their etiology.

Several of the soldiers exhibit healed (antemortem) battlefield injuries from previous engagements, and at least 15 individuals have unhealed (perimortem) projectile or blade induced injuries. There are no indications of surgical intervention associated the antemortem or perimortem traumatic injuries. Furthermore, most of the individuals have traumatic bone formation on the lower limbs resulting from strenuous physical activity. Most interestingly, nearly all of the males with femora present have a long and narrow area of periosteal reaction on the anterolateral surface of the proximal diaphysis. We hypothesize that this injury was caused by chronic muscle inflammation resulting from shooting their muskets "from the hip" instead of the shoulder.

Functional morphology of the hominoid clavicle.

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Shoulder girdle morphology in hominoids is related to body form and functional adaptation. Studies of pectoral girdle variation among hominoids have most often focused on the scapula. The clavicle has received comparatively little attention despite its potential to reveal important information about the functional morphology of the shoulder in early hominins, This research compares the morphology of extant hominoid clavicles in an effort to create a basis for understanding shoulder girdle functional morphology in *Australopithecus* and early *Homo*.

Clavicles of *Homo sapiens*, *Pan troglodytes*, *Gorilla gorilla* and *Pongo pygmaeus* from the Cleveland Museum of Natural History and National Museum of National History were compared metrically and non-metrically. Results show that although the clavicle varies within and among taxa, systematic differences among species are present. Human clavicles have a superoinferiorly expanded sternal end compared with those of apes, related to manubrial differences between extant apes and humans. Humans also have a large, laterally situated attachment for the sternocostal ligaments, while that of apes is smaller and medially restricted. *Pongo* has a more distally placed attachment for the coracoclavicular ligaments than do the other taxa, and increased torsion of the acromial end. There is also variation among taxa in deltoid muscle (Ohman, 1986), and in coracoclavicular ligament attachment geometry.

Intraspecific differences in clavicle morphology identified in this research reflect clavicular orientation and attachment of muscles and ligaments. These data can to be applied to functional analysis of fossil hominin clavicles, and so inform us about shoulder girdle morphology in fossil hominins.

Brain and somatic growth in strepsirrhines: implications for variation in life history.

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The large brains of primates are associated with slow life histories, which may be enforced by the costs of brain growth. Slowed somatic growth may compensate for rapid early brain growth, necessitating an extended interval between offspring and a delayed maturation.

To test these hypotheses, growth of the body and braincase was studied in three strepsirrhine species (*Daubentonia madagascariensis*: n = 3; *Propithecus verreauxi*: n = 4, *Lemur catta*: n = 5) housed at the Duke University Primate Center. The width and length of the cranium were taken periodically using calipers. Body weight, interbirth interval and age at maturity for each species were derived from the Primate Center records.

The hypothesis that larger brain size is achieved by increases in brain growth rate was supported. *Daubentonia* had a head growth rate nearly double that of *Propithecus* and *Lemur*. However, somatic growth rates in *Daubentonia* and *Lemur* were not significantly different from each other, though the two species are approximately the same adult body size and *Daubentonia* has an interbirth interval and age at maturity nearly double that of *Lemur*. These data suggest that there are other critical factors such as diet or behavioral development that explain the link between brain size and life history in these species.

Paleodemography and health in Predynastic Upper Egypt: a perspective from the working-class cemetery at Hierakonpolis.

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The rise of the Egyptian state was a complex process, involving increases in both population and per capita output. In his work on the Industrial Revolution in Europe, Komlos (1989) suggests that increased availability of nutrients provided many with an escape from the "Malthusian trap" that had served as a check on population growth for most of human history. Within an economic-historical framework, an expectation is that, for the emerging Egyptian state, overall disease and stress would have become so high, as to suppress production. Paleodemographic and paleopathological data from the working-class cemetery at Hierakonpolis (HK43) allow us to test hypotheses regarding the overall health of those paying the biological "cost" of increased economic productivity.

The age-at-death distribution at HK43 departs from what is normally expected in archaeological samples. Children younger than 5 years are underrepresented—

10.1% (42/415). Young adults, 20 to 35 years of age, comprise the largest proportion of the sample—40.0% (166/415). Frequencies of pathological lesions are highest—87.9% (29/33)—among subadults younger than 15 years of age and much lower—31.8% (54/170)—for young adults. Underrepresentation of young children is likely due to differential burial practices. The low frequency of pathological lesions, as well as other non-specific stress indicators (hypoplasias, Harris lines, etc.), among adults suggests that those interred at HK43 possessed the biological capital to support the socioeconomic changes that accompanied the unification of Egypt.

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A study of the L1c haplogroup of the mitochondrial DNA.

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In this communication, we present a study of the human mitochondrial haplogroup L1c which has been carried out on a total of 455 individuals from 27 African and American populations using both hypervariable regions 1 and 2.

The results obtained lead us to draw three main conclusions. First, the time to the L1c most recent common ancestor (TMRCA) has been estimated as 90,000 ± 13,000 YBP, substantially older than the previous estimate (59,650 ± 11,800) and in agreement with archaeological dating. Second, we observed that L1c frequencies reach very high values in Western Pygmies populations (from 86% to 98%), hunter-gatherers supposed to be the most ancient inhabitants of this area. Third and finally, the median networks built using our dataset change the phylogeny of the entire haplogroup. In fact, we present a substantially modified structure for the sub-haplogroups L1c1 and L1c3 and identify a new clade, L1c4 which contains mostly sequences from Pygmies.

Taking into consideration the L1c phylogeographic features together with archaeological knowledge, we propose that the hunter-gatherers communities living in Central Africa at least 40,000 YBP could be the ancestors of both Bantu and Western Pygmy populations. These two groups could have separated later on, because of the cycles of expansion and fragmentation of the forest environment occurred till 12,000 YBP.

As the next step of this research, we will sequence the complete mtDNA genome in order to test the robustness of the new phylogeny.

The use of biogeographical ancestry for forensic, biomedical, and recreational genomics.

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Ancestry tests using the Y-chromosome and mtDNA, similarly to the genealogists' lineage approach, are powerful at finding genetic relationships between individuals and groups. Whole-genome ancestry tests are able to predict biogeographical affinities of an individual with increased accuracy. Such methods estimate a person's genomic ancestry, i.e. the average level of admixture calculated throughout the genome using ancestry informative markers (AIMs).

Genomic ancestry has forensic applications such as estimating ancestry from evidentiary DNA samples. Ongoing research on facial features prediction is promising and already has good accuracy for predicting eye color. Examples will be given of successful applications to solving criminal cases, by predicting both a suspect and victim ancestry using evidentiary DNA.

Genomic ancestry tests are also useful to epidemiologists wanting to find out how admixture impacts drug response in clinical trials. Not controlling for ancestry can potentially bias case-control studies. Genomic ancestry estimates may indicate risk of susceptibility to certain conditions, hence helping doctors to select a diagnostic that might otherwise be too costly to apply to the whole population.

A growing number of people are curious about their ancestry. Genomic ancestry offers a necessary and complementary view to lineage methods.

Genomic ancestry measures depend on how good and how many the AIMs are, which analytical models are employed and who should be used as "parental" populations. Interpreting results requires careful consideration, especially for individuals that do not fit the initial population model. Using genetic and non-genetic information from other family members can be critical in this regard.

An analysis of health indicators in subadults from select Mimbres populations: Why is there no correlation?

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The Mimbres occupied sites in the Mimbres River valley from approximately 100 AD to 1200 AD in what is now southwestern New Mexico. The sites examined (Galaz, Cameron Creek, Hudson and Hot Springs) date to 1000-1150 AD when the Mimbres practiced intensive agriculture. Previous research on these populations has suggested there is no discernible correlation between two separate indicators of nutritional stress, Harris lines and enamel hypoplasia, in the studied populations. This study was expanded to focus on the health of subadults (n=56) from the same populations. Health was assessed by the following: presence or absence of periostitis and other indicators of infectious disease; cribra orbitalia, porotic hyperostosis, enamel hypoplasia, Harris lines and other indications of nutritional stress; dental pathologies including caries and abscesses; and long bone length relative to dental age.

Analysis indicates that while many of the above conditions are common among the Mimbres subadults, there is no clear correlation between any one of the indicators, even among those purporting to measure the same condition. For example, individuals with a discrepancy (.5 to 5 yrs) between long bone length relative to dental age are no more likely to exhibit Harris lines than an individual with no such discrepancy. This suggests the effects of the so-called "osteological paradox." Age-at-death disparities may also be a factor, as well as the possibility that the Mimbres suffered from a greater variety of stressors than previously thought. Implications for future studies of subadult health, the Mimbres, and the Southwest are discussed.

Iterative dispersal across Beringia by early Cenozoic primates.

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New records of early Cenozoic primates (sensu lato) from Asia reveal an iterative pattern of dispersal directly between Asia and North America at several times during the Tertiary. Current knowledge of early Cenozoic paleogeography suggests that the only viable route for primate dispersal between Asia and North America would have traversed Beringia. Because primates are among the most thermophilic of living mammals, these instances of trans-Beringian dispersal by early Cenozoic primates serve as useful proxies for globally warm climatic conditions.

The earliest evidence for primate dispersal between Asia and North America dates to the Paleocene, when a variety of carpolestids are known to occur on either side of the Pacific Basin. The well-known episode of global warming at the Paleocene-Eocene boundary marks the first record of euprimates in North America

and Europe. Phylogenetic data and new paleontological evidence suggest that these earliest North American and European euprimates arrived from Asia, traversing the Beringian region as a direct response to global warming at the Paleocene-Eocene boundary. Later episodes of Tertiary primate dispersal across Beringia occurred during the middle Eocene and near the Oligo-Miocene boundary. Additional episodes of Tertiary primate dispersal between Asia and North America are likely, but these remain undocumented by fossils.

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An evaluation of possible associations between skeletal remains and Mimbres ceramic typology: The Galaz Ruin.

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Galaz Ruins, a Mimbres site located in southwestern New Mexico, was excavated during the summer seasons of 1929, 1930 and 1931 by the University of Minnesota. 995 burials were excavated, containing 982 ceramic vessels. Separate records were kept of the excavation of the remains and the ceramic vessels. A preliminary skeletal analysis was completed in the field on certain remains; however the majority of the remains went unanalyzed. Subsequent publications concerning these remains focused only on the possible age and sex of the individual, without regard to the mortuary goods interred with them. The purpose of this study was to identify sex, age and any possible pathology of these remains, and to associate the remains with their interred mortuary goods. The ceramic vessels were matched with their associated remains by correlating the inventory records from the University and the field notes from the excavations. The skeletal material was analyzed and divided into groups by age and sex. Forty-one percent of the individuals from Galaz were interred with ceramic vessels. The subadult group was more likely to be interred with at least one vessel, with several individuals having more than one. No difference was seen between the number of vessels interred with males or females, however, males in this study were more likely to be interred with Mimbres Classic black-on-white style III.

The lumbar lordosis of *Homo neanderthalensis*.

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In the last century, the question of Neandertal posture attracted a great deal of attention. The first to address the question was Marcellin Boule (1911-1913) who claimed that Neandertals had a rounded back with reduced lumbar lordosis. Later researchers disagreed with Boule's conclusions and claimed that Neandertal posture was not different from the posture of *Homo sapiens*. In this study we compared the osseous lumbar lordosis of Neandertal and *H. sapiens* and estimated the degree of Neandertal lumbar lordosis.
The sample included 75 lumbar spines (T_{11}–L_5) of *H. sapiens* and seven early hominids; three early *H. sapiens*—Cro-Magnon 1, 2, and 3—and four Neandertals—Kebara 2, Shanidar 3, La Chapelle-aux-Saints, and one vertebra of Regourdou. The body angle of each vertebra (T_{11}–L_5) was measured.

Our results show that in the middle-upper lumbar vertebrae (L_1–L_4) and the lower thoracic vertebra (T_{12}), the body angle in Neandertal is significantly more kyphotic than in *H. sapiens*. The cumulative angle of adjacent vertebrae (T_{12}–L_4) in Neandertal is more kyphotic than in *H. sapiens*. Our findings indicate that Neandertal posture is characterized by hypolordosis as a result of hyperkyphosis in the thoraco–lumbar spine. Hypolordosis is associated with a posterior shift of the rib cage, posterior pelvic tilt, a more vertical orientation of the sacrum, and short stride.

Stem hominine or hominid? The phylogeny and functional anatomy of *Pierolapithecus catalaunicus*.

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The recent publication of *Pierolapithecus catalaunicus* (Moyà-Solà et al., 2005) raises interesting questions regarding great ape evolution. We compared published descriptions and photographs of *Pierolapithecus* to other Miocene and extant hominoids.

The I^1 and M^3 of *Pierolapithecus* are strikingly similar to isolated specimens attributed to *Dryopithecus fontani* from La Grive, France. The dentition is similar to *Dryopithecus* specimens from Spain and Hungary, in terms of morphology and most proportions. Based on its photo, we consider the published reconstruction of *Pierolapithecus* face to be unlikely, given apparent damage to the specimen. Glabella appears to originally have been more anterior and the base of the nasal aperture is artificially elevated above the subnasal floor. An alternative reconstruction is presented here, testable by examination of the fossil. We present evidence from the vertebral column and phalanges that indicates well developed suspensory positional behavior.

Based on published data, we interpret *Pierolapithecus* to be a stem hominine distinct from samples currently attributed to *Dryopithecus* from Spain and Hungary. It is difficult to distinguish *Pierolapithecus* either from the type of *Dryopithecus* (*D. fontani*), a mandible, or the specimens from La Grive. It may be, given morphological similarities, and the fact that *D. fontani* is the same age (MN 7/8) and geographically close to Can Vila, that *Pierolapithecus* is synonymous with *Dryopithecus*. If so, one or more available nomena will need to be resurrected to distinguish MN 7/8 *Dryopithecus* from the morphologically different and more derived MN 9 taxa.

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Serial coalescent simulations suggest weak genealogical relationships between Etruscans and modern Tuscans.

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The Etruscans, the only preclassical European population that has been genetically characterized so far, share only two haplotypes with their modern counterparts, the Tuscans, which, however, appear to be their closest living relatives.

We model ten demographic scenarios along the last 2,500 years and test by serial coalescent simulation whether any of them can account for the levels of internal genetic diversity observed in the Etruscan and modern Tuscan samples, and for their degree of genetic similarity. None of the five models in which the Etruscans are the direct ancestors of modern Tuscans is fully compatible with the observed data. On the contrary, the low level of allele sharing observed between the ancient and the modern samples is only obtained in simulations where those samples were extracted from independently-evolving populations, connected by little migration. A good correspondence between simulated and observed parameters is also obtained for a scenario in which the ancient samples come from a social elite, genetically differentiated from the bulk of the Etruscan population. In principle, these results may be due to factors such as a mitochondrial mutation rate much higher than currently believed, gross and systematic errors in the ancient

DNA sequences, and failure to sample suitable modern individuals. If none of the above proves to be the case, the only possible conclusion of this study is that the Etruscans left very few or no mitochondrial descendants in the modern population of Tuscany.

The possible causes of porotic hyperostosis in Mesolithic Denmark.

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In a study of Mesolithic skeletons from Denmark it has previously been reported that several skulls showed evidence of porotic hyperostosis (Meiklejohn and Zvelebil 1991). As the condition did not fit the classic pattern of this pathological changes in populations which are either heavily dependent on a cereal diet, suffer from malaria or live in an area with a high population density, the authors suggested that it could be attributed to fish tapeworms. This may seem to be a reasonable suggestion as C-13 results and the presence of fish bones have revealed that the Mesolithic population was heavily dependent on a marine diet.

The Danish Mesolithic skulls and skull fragments of 25 individuals have been reexamined in order to study both the presence and pattern of porotic hyperostosis. It showed that more than half of the skulls do have some porotic areas, but of various distribution and location. The study has revealed a different interpretation of the bone changes. Other possible causes are suggested such as growth and hypervascularity resulting in cranial vault thickening and in some of the cases the porotic areas are clearly related to healed traumas.

How standard are our *standards*? Inter-observer consistency in the construction of age intervals and the implications for broader anthropology.

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To estimate the age-at-death of skeletal remains, a suite of dental and osteological variables are routinely employed. Although various multi-trait methods have been suggested, differential method selection among investigators persists. The purpose of this investigation is multifocal: 1) compare the consistency of age-at-death estimation among observers for the independently scored data, and vise-versa; 2) investigate the criteria each investigator uses to construct age intervals; and 3) explore the "intangibles" or the "art" of age interval construction.

The investigation is based upon the data collected from a forensic collection of identified individuals originating from Kosovo. The sample was selected to incorporate all age categories for both males and females aged 17 to 60+ years. The methods included the Suchey-Brooks (1990) and Todd (1920, 1921) scoring systems for pubic symphyses, the Iscan *et al.* (1984) method for the sternal fourth rib end, and the Prince and Ubelaker (2002) equations for the Lamendin method for single rooted teeth. The Berg *et al.* (in press) method for aging older female pubic symphyses was employed for the study of females, where appropriate.

Statistical correlation between the investigators was moderately high for females (0.74) and lower for males (0.62). A trend to overestimate age was present for male individuals, whereas no apparent trend was present for females. Construction of the age-at-death intervals was greatly influenced by the results of each scoring method and the confidence each investigator had in a given method.

Hormones and body size evolution in papionin primates.

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Ontogenetic studies focusing on humans and nonhuman primates reveal that an adult morphology can be produced through different developmental processes, generally involving differences in the rate or timing of somatic growth. We examine the evolution of size variation in papionin primates by measuring key growth regulating hormones during ontogeny (IGF-I, IGFBP-3, DHEAS, testosterone, estradiol), in order to assess which endocrine variables may be combined to result in a large or small adult body size, and whether or not different developmental processes can lead to similar body sizes. Importantly, because the papionin molecular phylogeny implies at least two episodes of size increase, this group offers an opportunity to determine whether or not similar endocrine profiles during growth regulate this apparent convergence. 583 serum samples from twelve papionin species were analyzed utilizing immunoassay techniques. Results show that comparable adult body size can be attained despite differences in levels of growth regulatory hormones during development. Additionally, this study demonstrates that absolute hormone levels during growth do not necessarily relate to adult size, contrary to the findings of previous research utilizing single species, with some smaller-bodied papionin species exhibiting higher growth related hormone levels than larger-bodied species. These results have important implications for understanding body size evolution in papionins in particular and primates in general.

A test of the transition analysis method for estimation of age-at-death.

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Using criteria proposed in the Rostock Manifesto, Boldsen and coworkers (2002) present a new method for age-at-death estimation. Specifically, this method utilizes a scoring system that incorporates familiar morphological markers of the pubic symphysis, auricular surface and cranial sutures. The authors argue that the technique improves estimating age-at-death in older adults and no longer forces workers to use an open-ended interval such as 50+ years. In addition, the authors suggest that their approach of combining multiple components from several morphological structures helps control the variability of the aging process. While results achieved in their initial study are favorable, Boldsen *et al.* maintain that additional validation studies are needed.

This paper presents results of one such validation study. Data were collected from a sample of the William M. Bass Donated Collection (n=223) following Boldsen *et al.* (2002) protocol. Mean age-at-death for the sample was 60.1 years which proved ideal for testing the technique on individuals representing older age cohorts. Age-at-deaths estimates were generated and statistically compared to real age. Results indicate that the method was able to generate age-at-death estimates well above 50+ years. In some cases, generated ages were very close to real age, even in the eighth and ninth decades. Such results indicate that this technique can enhance age-at-death estimation and be of value to numerous physical anthropological contexts.

Sex-based differences in dental health and diet: the Toqua Site, eastern Tennessee.

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Dental health can provide a strong inference about dietary variation. In a wide range of settings, differences in dental caries and other oral pathological conditions provide implications about male and female dietary behavior and quality of life. Generally, females show a higher prevalence of dental caries than males, suggest-

ing a greater consumption of cariogenic foods. In this paper, we test the hypothesis that females will show a greater prevalence of dental caries than males in late prehistoric (Mississippian) maize agriculturalists from the Toqua site in eastern Tennessee.

Dental caries, antemortem tooth loss, and periodontal defects in the permanent teeth of 69 adults (35 males, 34 females) were documented. Statistical analysis of these data reveals no significant differences between adult males and females (chi-square; $p<0.05$). We interpret the overall similarity in frequency of pathology to indicate that oral health in general and diet in particular are not different between males and females. These results contradict most analyses in agricultural settings, especially in the American Southeast. On the other hand, analysis of other indicators of health (enamel hypoplasias, porotic hyperostosis, and periostitis) shows no differences in this series. Together, these results suggest that although there may have been a sexual division of labor, it did not impact diet and general health, at least as they are measured by these indicators.

Screening candidate genes for evidence of natural selection in Andean populations.

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The hypoxia inducible transcription factor (HIF) pathway, involved in oxygen homeostasis, regulates many of the physiological responses to high altitude habitation. Thus, genes involved in this pathway (as well as additional genes with purported high altitude adaptive mechanisms) are candidates for natural selection. Single nucleotide polymorphism (SNP) methods can be used to test such candidate genes, for evidence of natural selection. One approach is to assess the level of allele frequency differences between the study populations at SNPs located in the candidate genes in contrast to the empirical distribution of large numbers of SNPs throughout the genome using statistics like F_{ST} (Akey *et al*., 2002). SNPs from *Edn1*, *Nos2a*, *Egln3* and *Vegf* genes in the HIF pathway were analyzed in a panel of Bolivian Aymara and Peruvian Quechua as well as low altitude control populations (Maya, Nahua, Africans, Europeans, Han Chinese and South Asians) for evidence of natural selection. Locus specific F_{ST} (lsF_{ST}) from HIF pathway SNPs was then compared to lsF_{ST} from a genome wide SNP dataset generated using the Affy 10K SNP mapping array to identify genes sharing strong of evidence of genetic adaptation. None of the HIF pathway SNPs showed evidence of natural selection among Aymara or Quechua based on lsF_{ST} methods. However, further analysis currently underway using haplotype based methods and heterozygosity may result in an alternate finding. These methods will be discussed in terms of the implications for this approach on searching for natural selection.

Beyond the letter of the law: fleshing out identity as a collaborative process.

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The NAGPRA mandate requires federally funded institutions to assess cultural affiliation for remains thought to be of Native American origin. However, remains sometimes surface that call out for identification efforts beyond that required by law. It is not enough to identify sex, age and ancestry alone; one must make further efforts to identify an individual beyond these standards. In the spring of 2005, lab cleaning at Minnesota State University, Mankato led to the discovery of a tattered note card suggesting that a solitary skull, previously overlooked, was most likely of Native origin. Prior to its arrival at MSU, Mankato the skull had apparently been a museum display. The skull represents a probable male between 15-20 years of age. The adolescent evinces cribra orbitalia, possibly linked to iron-deficiency anemia. Ethnohistorical, archaeological, and osteological lines of evidence, including newspaper research, informal interviews, museum visits and literature investigation, suggest that the individual is of Native American ancestry and lived after 1860 A.D. This study identifies the responsibility that anthropologists may have in ameliorating past practices and suggests ways in which anthropologists may engage and collaborate with members of communities that have personal involvement in the goal of identification. Although to date the individual remains unidentified, the effort is ongoing. While fleshing out a specific identity may not be a matter of global import, small mysteries can help to put a personal face on anthropological research.

Locomotor behavior of *Cercopithecus nictitans stampflii* in the Tai National Park, Ivory Coast.

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Stampfli's putty-nosed monkey *Cercopithecus nictitans stampflii* is a poorly known, critically endangered guenon found discontinuously and at low densities from Liberia to Cameroon. Various authors have used competitive displacement by Diana monkeys (*C. diana*) to explain its sporadic distribution. *C. nictitans stampflii* is one of the largest, most dimorphic guenons and information on its locomotion can provide clues about the radiation and distribution of the clade's members.

We studied the positional behavior of putty-nosed monkeys for 15 months in the Tai Forest. We used an instantaneous time point sampling regime to collect basic data on locomotion, posture and habit use and compared our results with data on the other Tai guenons, *C. diana*, *C. campbelli* and *C. petaurista*.

Although overall locomotion of *C. nictitans stampflii* (climb = 15.2%, leap = 10.4%, walk = 65.2%, run = 9.1%) is similar to that of the other Tai guenons (including Diana monkeys), its use of forest strata differs significantly from its congeners. Putty-nosed monkeys prefer main canopy layers during most activities, rarely descending to strata below the under-story. Over 80% of all locomotion occurred on boughs or branches; boughs are preferred for travel and branches are preferred for foraging. Relationships between locomotion and maintenance activities are consistent with results from other studies: climbing occurs more during foraging and leaping is more frequent during travel. Despite intense feeding competition, putty-nosed and Diana monkeys spend considerable time in association with each other, a phenomenon made possible by canopy segregation.

A cautionary tale: Alleged Asian palm burial remains prove not so Asian.

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Recent removal of a palm tree yielded the remains of two individuals. Initial investigation by a forensic anthropologist determined the remains to be young adult females of Asian, specifically Chinese, descent. This conclusion wasn't far-fetched, for the area was used as a Chinese cemetery from 1870 to 1950 located in Bakersfield, California. All of the remains were relocated in the mid-1950s, but looting led to loss of many headstones. Hence, it was likely that some remains were unintentionally left behind.

Further investigation yielded different results. Burial 1 was identified as a male African American who died between 44 and 49 years of age. Burial 2 was identified as a Caucasian male who died between 30 and 36 years of age. Such disparate results stimulated archival inquiry into the composition of the "Chinese cemetery." The research revealed that, while

dominated by individuals of Asian ancestry, the cemetery was also used by indigents regardless of ancestry. In addition to being African American, Burial 1 was marked by postcranial robusticity and may have been one of a number of African Americans employed as laborers for the local railroad. Burial 2, appears to have been autopsied, was accompanied by the remains of a coffin latch, and may be one of several individuals identified as "white, but of an alcoholic disposition, possibly Irish." As such, this serves as a cautionary tale. Burials may not be as they initially seem. Investigators must use cautious consideration, not exclusively context, when forming conclusions about the identity of individuals, even those recovered from known historic cemeteries such as this one from Bakersfield.

Femoral shape in populations of differing subsistence economies.

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Activity-related stresses and mechanical loadings have been demonstrated to affect adult bone morphology reflecting population differences in diet, mobility levels, and gender roles. For example, femoral diaphyseal geometry has been used to differentiate between mobility patterns of foragers and agriculturalists. When subsistence patterns are known, the assumption is that a particular pattern of lower limb morphology should result. However, research has shown that the relationship between diet, presumed activities, and bone geometry is not always straightforward. This study examines how well skeletal morphology correlates with presumed activity patterns in populations whose subsistence economy is known from archeological evidence. Three samples from populations that practiced: 1. coastal hunting, foraging and gathering; 2. maritime; and, 3. broad-based subsistence economies were used to collect data to calculate femoral shape and robusticity. The results reveal that when a subsistence economy is exclusively practiced and competing variables are controlled (e.g. terrain), limb morphology reflects activities patterns associated with that economy. However, when subsistence practices are broad-based bone geometry does not provide a clear pattern of activities and thus the archeological and skeletal data do not correlate strongly in these circumstances. Since bone geometry alone does not always reflect the subsistence economy (and vice versa), this finding is particularly relevant for studies of populations undergoing transition, such as from foraging to agriculture.

Quantitative genetics of female rhesus macaque age-specific reproductive output: Evidence for trade-offs and their implications.

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Trade-offs among components of fitness are fundamental to life history theory. Little is known about the genetic architecture of trade-offs, and thus how fitness costs and benefits accrue to individuals based on their reproductive decisions.

Using demographic records from 351 females completing their lives in the Cayo Santiago, PR colony, genetic correlations were calculated between reproductive output, the number of offspring born to a female, in early (3-5 yrs. old), middle (6-10), and late (11+) phases of life. To identify how correlations in reproductive output arise, the relationship between early fertility (3-7) and lifespan was also calculated for a subset of females (n=239) who lived 8+ years. Genetic analyses utilized an animal model and a pedigree of almost 8000 individuals having over 7000 maternal, and 200 paternal links. REML estimates of (co)variance components were generated with the program VCE. Parametric correlations were used.

In contrast to positive or ~0 phenotypic correlations for reproductive output at different ages, the genetic correlations indicate a strong trade-off between early and late life output. Furthermore, though the phenotypic correlation is also ~0, a strong negative genetic correlation between early fertility and lifespan indicates the early-late reproductive output correlation is predominantly due to earlier death of females who bear many offspring early in life.

These patterns support an antagonistic pleiotropy model for the evolution of senescence and imply constraints operative in primate life histories can be identified using long-term records that include pedigree information. Outlining morphological and socio-behavioral relationships to these reproductive constraints are directions for future inquiry.

Research supported by the U. Illinois Graduate College. Cayo Santiago and the Carribean Primate Research Center are NSF, NIH, and UPR funded facilities. Paternity data, used under agreement in this research, was gathered by John Berard, Fred Bercovitch, Matt Kessler, Michael Krawczak, Peter Nurnberg, and Jorg Schmidtke.

Sexual dimorphism and indicators of substrate preference: implications for fossil species.

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Researchers have identified multiple indicators of locomotor pattern in cercopithecoids, as well as many other species of mammals. Indicators of terrestriality or arboreality in primates include height of the humeral head relative to the greater tuberosity, retroflection of the medial epicondyle of the humerus, length of the radial neck, posterior inclination of the olecranon, and length of the phalanges. Preliminary investigations suggest that allometric differences in the forelimbs of Old World monkeys related to sexual dimorphism may be a confounding factor in our estimation of locomotor pattern in fossil species of monkeys and apes. The generation of coefficients of variation (CVs) in a comparative sample of extant anthropoids produces very large CVs associated with radial neck length, particularly among cercopithecines. As neck length relative to radial head diameter is often used as an indicator of substrate preference or degree of cursorial activity in many mammals, further CVs were generated to ascertain if high degrees of variation also occur for this measure. As it also produced high CVs, means for males and females were then calculated to determine if the variation is related to sex differences. In two of the species, *C. mitis* and *M. fascicularis*, the differences are significant at the .05 level. Further calculations of other indices related to substrate preference produce similar results. These findings have significant ramifications for the assessment of substrate preference in fossil specimens, as well as taxonomic attribution. Additionally, these determinations may impact paleoecological models of habitat and assessments of number of species present.

Life history trade-offs in human growth.

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Human beings growing-up in adverse environments may be stunted, have asymmetric body proportions, be wasted, be overweight, and be at greater risk for disease. One group of researchers explains this as a consequence of "developmental programming" (DP). Another group uses the phrase "predictive adaptive response" (PAR). The DP group tends to view the alterations as having permanent maladaptive effects that place people at risk for disease (Barker, 1998). The PAR group considers the alterations at two levels of adaptation: 1) "short-term adaptive responses for immediate survival" and 2) "predictive responses required to ensure postnatal survival to reproductive age" (Gluckman & Hanson, 2005, p.68).

In a strict biological sense, adaptation is operationalized in terms of reproductive outcome. There is no consistent evidence

that deviant growth trajectories impair or enhance fecundity or fertility. An application of life history theory to human growth rephrases the DP vs. PAR debate from disease or adaptation to the concept of "trade-offs." "Trade-offs occur when two traits compete for materials and energy within a single organism…" or, "…when selection for one trait decreases the value of a second trait" (Stearns, 1992, p. 223). Human life history includes four stages of growth between birth and adulthood: infancy (birth to 36 months), childhood (3 to 7 years old), juvenile (7 years to puberty), and adolescent (puberty to about 20 years). Each of these stages is replete with trade-offs for growth and health. We present examples of trade-offs in growth of body proportions of Guatemalan and Cape Verdean children, juveniles, and adolescents and how these proportions relate to functional outcomes.

Leprosy in the medieval North.

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Leprosy was a widespread and dreaded disease in medieval Europe. It had reached Scandinavia by the Roman Iron Age (around AD 400). After a peak prevalence around AD 1300 the disease declined in frequency but remained of public health concern in parts of Scandinavia to well into the 20th century.

This paper analyzes the relationship between leprosy prevalence in different parts of the North population from around AD 1000 to the Protestant Reformation in the first half of the 16th century. Four different population segments are examined, the urban and the rural populations of South Scandinavia, and the more marginal populations of North Scandinavia and the Greenland North are analyzed.
It appears that leprosy was present in all of Scandinavia between AD 1000 and 1300. After 1300 the prevalence dropped quickly and dramatically in the urban communities of South Scandinavia, whereas it remained high to the 16th century in the rural majority of the population in South Scandinavia. In North Scandinavia, leprosy appears to have been more prevalent among the Sámi than among the North population. It appears that leprosy did not establish a presence among the Greenland North in the early part of the settlement history; it might have appeared later in the history but no data with bearing on this have been analyzed so far.

The observed pattern of leprosy prevalence is discussed in the light of population dynamics and the economic development during the Middle Ages.

The impact of genetic ancestry testing on public understanding of race and human genetic structure.

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Genetic ancestry testing has become a profitable commercial venture in recent years, and more than 20 private companies now sell genetic tests to help members of the general public reconstruct their personal genealogical histories. Since these companies discuss the pattern of human variation in their daily interactions with non-anthropologists, they can have a significant impact on how the public understands the structure of the human gene pool. In this presentation, I examine what these genetic ancestry tests convey about race, ethnicity, and human genetic structure.

While some aspects of genetic ancestry testing help to refute incorrect ideas about race, other aspects of these tests and the associated literature instead reinforce traditional racial notions about the genetic structure of human populations. In many cases, the pattern of human genetic variation is oversimplified and misrepresented. These tests often imply a greater correspondence between racial/ethnic groups and genetic markers than really exists, and the literature associated with some tests supports a traditional racial view of human population history. Many aspects of genetic ancestry testing therefore serve to reify race as a biologically meaningful representation of human variation. Finally, I also discuss the meaning and use of the term "ancestry" (in contrast to "race" or "ethnicity") as associated with these tests.

Dental and skeletal maturation in wild great apes.

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Examination of dentition and skeleton of immature wild great apes (orangutans, n= 18; gorillas, n = 31; chimpanzees, n=28) reveals variation in patterns of growth and development. Individuals are classified into one of six dental ages, based on type and number of teeth emerged. On the same individuals, skeletal elements of the long bones and pelvis are scored according to degree of fusion (none, partial, full). Females and males are compared within a species, and each then compared across species.

Results show that chimpanzees and gorillas initiate skeletal fusion relative to dental stage earlier than do orangutans. In the pelvis and elbow for example, female chimpanzees and gorillas begin fusion at the same dental stage (age class 3, with second permanent molar (M2) emerged), whereas in female orangutans, the process occurs in age class 4 (denoted by permanent canine emergence). In African apes, pelvic fusion is completed later in males than in females, but at different dental ages, for example, gorillas are later than chimpanzees.

In all great apes, skeletal maturation occurs after all permanent teeth have emerged and suggests caution when using "adult" museum collections for wild primate baselines. For example, male gorillas with all permanent dentition and extensive tooth wear can have most skeletal elements still unfused. Using field measurements from these postcranial immatures to estimate wild body masses, for instance, under-estimates them.

The variation in timing and sequence of skeletal development within and between species reflects the life history pattern in each of these three great apes.

A reassessment of the age at death of Sts 14 (*Australopithecus africanus*) and the sequence of epiphyseal union of early hominids.

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The present study attempts to establish a reliable age-at-death estimate for the *Australopithecus africanus* associated pelvis and vertebral column Sts 14. Originally considered to be an adult specimen by Robinson, more recent studies have suggested a subadult age at death for this individual. Our examination of the original specimen has revealed the presence of a small open suture along the iliac crest, an incipient ventral rampart, what appears to be a mostly unfused ischial tuberosity, S1-S2 unfused intervertebral disc, partial fusion of the sacroiliac epiphyseal plate and incomplete fusion of the annular rings of most of the preserved vertebrae. Considering that the *A. africanus* developmental rate more closely resembles that of chimpanzees than living humans, an age at death of 13-16 years for Sts 14 is suggested.

We have studied the sequence of epiphyseal union in other early hominid pelvic remains and compare this sequence with living great apes and modern humans to determine whether the early hominids were characterized by a distinct sequence of epiphyseal fusion in their pelvis. Interestingly, in SK 3155 (*Paranthropus robustus*) the fusion of the epiphysis of the anterior inferior iliac spine in the early hominids seems to be advanced with respect to the ossification of the

triradiate cartilage. In addition, the sequence of epiphyseal union in Sts 14 appears to show a non-fused ischial tuberosity and an almost fused iliac crest. This condition in Sts 14 could be due to either a taphonomic process, or a change in the sequence of epiphyseal union.

Allometry and classification in Fetal Alcohol Spectrum Disorders, or, What happens when an allometric null hypothesis is true.

F.L. Bookstein, University of Vienna, University of Washington

Fetal Alcohol Spectrum Disorder (FASD) is a common birth defect (circa 1% in the US), centered on the brain, with devastating consequences for cognition and social behavior. The earlier in life these cases are diagnosed, in general, the better the outcome. Current developments in craniometrics have proved remarkably helpful for the neuromorphometrics of this related topic.

While our previous work focused on quantifying the corpus callosum midcurve, this report deals with the cerebellum. There is a strong pattern of cerebellar shape allometry in normal variation that, when tested against the corresponding pattern in FASD, appears to be "significantly supported" (i.e., the null hypothesis is TRUE) in comparisons of 120 Seattle FASD adolescents and adults to 60 subjects unexposed to prenatal alcohol. In other words, the size difference engendered by the syndrome adequately accounts for observed shape effects.

The role of shape is then to serve as a redundant source of information about the birth defect in this context, in which image processing is somewhat difficult and biological variability is exaggerated beyond the normal. Classification under these circumstances goes best by a third method, principal components of the size-shape spaces that our group introduced in 2004 for the considerably different topic of hominoid phylogenetics. The resulting example of "classification by allometry" may be of interest to physical anthropologists more broadly whose data sets likewise combine strong allometric signals with weak or variable residual effects.

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DLX and anthropometric variation in children with oro-facial clefts.

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With the availability of the human genome sequence, molecular anthropology has developed to a point where classical anthropometry can start to be brought into conjunction with molecular data. Children with orofacial clefts have been shown to differ from unaffected children in their growth accomplishments in certain age ranges based on measurements of their heights. Studies of developmental genetics have shown that some anomalies once thought to have multifactorial etiologies are sometimes due to mutations in upstream developmental control genes which can have widespread downstream effects. This paper explores whether this might be the case with respect to the DLX genes or their control in children with clefts of the primary palate. DLX products appear to be involved in bifrications where single structures give rise to pairs as when the lateral facial processes grow out to form the jaws. My work on morphology in children with clefts has shown that they are slightly shorter than average after the age of seven, the expected age at andrearche. They have consistently significantly narrower elbow breadths, where the single humerus anlagen divides to form those of the radius and ulna. Children with clefts also frequently show deficits in the ulna styloid, and small carpals on one side of the hand, regions where further developmental bifrications occur. Here I review the evidence for a role for the products of the DLX loci in jaw formation and so possibly in clefting, as well as their reuse in more distil bifrications. I examine whether biacromial and bi-iliac breadths, collected on children attending the Cleft Palate Service of the Philadelphia (PA) Facial Reconstruction Center, support an hypothesis of a role for DLX product alteration in the formation of clefts of the primary palate.

Electromyography of peroneus longus in *Varecia variegata* and *Eulemur rubriventor* helps in grasping primate origins.

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The evolution of a foot specialized for strong grasping with an opposable hallux has been recognized as an important step in the evolution of euprimates. It may have allowed the earliest 'primates' to utilize resources previously unexploited in a fine-branch niche. Thus, paleontologists have studied osteological correlates of strong hallucal grasping with the goal of identifying this ability in fossil taxa. One character considered an indicator of such grasping is a large peroneal process on the hallucal metatarsal. Notably, this process is the sole insertion point of the peroneus longus muscle in nonhuman primates. Because the peroneus longus tendon crosses the tarsometatarsal joint, it is capable of adducting the hallux and is thought to be critical for strong hallucal grasping. However, this function in strong hallucal grasping has yet to be demonstrated. We used telemetered electromyography on two lemur species and found that peroneus longus is not frequently or consistently active during hallucal grasping. Further, it is never active without accompaniment of other muscles during such grasping. In contrast, extrinsic digital flexor muscles of the hallux are almost always intensely active in all grasping behaviors observed. Peroneus longus helps evert the foot, resists its inversion, and resists abduction of the hallux on large diameter horizontal substrates. We conclude that peroneus longus is not important in strong hallucal grasping and that strong adduction of the hallux is not necessarily a component of such grasping. These results have implications for the functional morphology of the foot in the earliest euprimates and plesiadapiforms.

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Evolutionary genetics of primate hair pigmentation.

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Primates often show striking coat color differences between closely-related species, between individuals within populations, between males and females, and between infants and adults. These various color patterns undoubtedly play an adaptive role in signalling and/or concealment, but we know little about the genetic basis of this coat color diversity.

We are examining hairs from a range of primates (humans, apes, New and Old World monkeys, and prosimians) to identify where in the pigmentation pathway hairs of various colours diverge in their patterns of gene expression. Our candidate gene approach focuses on eight pigment-related genes (*MC1R*, *ASIP*, *POMC*, *MGRN1*, *ATRN*, *TYR*, *TYRP1*, *DCT*), selected because of their known involvement in determining coat colour in mice, one melanocyte marker gene (*MITF*) and one house keeping gene (*ACTB*). We extracted RNA from plucked hair tufts consisting of approximately 10-50 hair follicles each. Using quantitative RT-PCR, we measured and compared the relative amounts of RNA specific for each gene in hair tufts of different colours (white, buff, red, brown, black) from numerous individuals representing a variety of taxa. Preliminary data suggest, for example, that changes in gene expression in specific loci underlie the black coat of Goeldi's monkey (*Callimico goeldii*). If confirmed,

this would be a novel mechanism for evolutionary change in coat colour. Results will provide insights into how evolution tinkers with a limited amount of genetic variation to produce such a great diversity of forms.

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The endocast of KNM-ER 42700 a new *Homo erectus* from Ileret, Kenya.

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The 1.5-1.6 Ma KNM-ER 42700 calvarium is a unique addition to known fossils in this time range from East Africa. While its general features show affinities to *Homo erectus* (including *H. ergaster*), it also possesses features that are similar to *H. habilis* (Spoor et al., 2005). This, though, may be attributed to the likelihood that the calvarium was from a subadult or young adult.

The calvarium is well-preserved with some distortion and a slight depression and hole anterior to the apex. Original estimates of the endocranial capacity gave a size of approximately 691-720ml, depending on the age of the individual. This would give KNM-ER one of the smallest cranial capacities of any fossil assigned to African *H. erectus*, albeit comparable to the endocranial volumes of Dmanisi and Mojokerto. However, past experience has demonstrated that deriving cranial capacity from CT images of a specimen with distortion is difficult. However, these problems can be overcome through the production of a stereolithograph derived from a 3-D composite of the CT images. This approach enables multiple casts to be created that can then be reconstructed to derive a more accurate assessment of endocranial capacity. Preliminary data indicate that KNM-ER 42700 is unique among *H. erectus* in its size, but overall possesses general affinities allying it with other members of this taxon.

Accumulating agent and paleoenvironment of the hominin-bearing site of Plovers Lake, South Africa.

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A sample of faunal material from Middle Stone Age levels at the cave site of Plovers Lake, South Africa, was examined to assess accumulating agent and paleoenvironment. Bone surface modification, bone breakage patterns and skeletal part representation, along with the presence of numerous coprolites, suggest significant carnivore involvement. Rodent gnawed bones are rare, indicating limited input from this agent. Hammerstone percussion- and cut-marked bones combine with the presence of tools of an MSA character to indicate some hominin contribution, though at a low frequency. Commingling of carnivore and hominin modified remains suggests either short-term, episodic utilization by the hominins, or perhaps seasonal occupation of the site. The majority of the fauna are representatives of extant taxa, most of which are historically known from the area. Carnivores are particularly diverse, with more limited primate representation. Examination of the ungulate fauna provides information on paleocommunity structure and paleoecology. There is a distinct preponderance of grazers, in particular those preferring open grassland habitats. Water dependent taxa dominate the ungulates, and coupled with the presence of aquatic species such as water mongoose and Cape clawless otter, suggest a permanent water source nearby. The greater part of the ungulate fauna are taxa which are characterized by at least some seasonal mobility, which has implications for interpretations of seasonal occupation in the area.

Darwin, Darwinism, and the speciation process.

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Pre-Darwinian biologists conceived of species as natural classes defined by essential properties. Nowadays, species are often thought of as logical individuals that are born and die in swift, transforming speciation events, in which reproductive isolation is achieved by the restructuring of a peripheral population's genome. But except in cases of instantaneous speciation through polyploidy (which is rare among animals and almost unknown among mammals), reproductive isolation and the mechanisms that maintain it can only be produced by natural selection, drift, and other evolutionary processes within populations. Darwinian theory therefore leads us to expect that reproductive isolation should as a rule come into existence gradually. Darwin himself argued at length that reproductive isolation admits of degrees, that interspecies gene flow is widespread and often significant, and that "there is no fundamental distinction between species and varieties." Later studies have borne out these contentions. We suggest that currently prevailing philosophies of systematics encourage paleoanthropologists to contrive overly precise alpha taxonomies that misrepresent the inherently vague boundaries of evolving populations.

The reliability of the *atd* angle in dermatoglyphic analysis.

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The *atd* angle is a dermatoglyphic trait formed by drawing lines between the triradii below the second and fifth digits and the most proximal triradius on the hypothenar region of the palm. The trait has been widely used in dermatoglyphic studies, but several researchers have questioned its utility, specifically whether or not it can be measured reliably. Here, we examine the measurement reliability of this trait. Finger and palm prints were taken using the carbon paper and tape method from 287 individuals with *in utero* exposure to alcohol and 175 unexposed controls. A sample of 100 matched (right and left) prints was randomly selected from the total. Each *atd* angle was read twice, at different times, by Reader 1, using a goniometer and a magnifying glass, and three times by Reader 2, using Adobe Photoshop. Inter-class correlation coefficients were estimated for the intra- and inter-reader measurements.

Reader 1 was able to quantify the *atd* angle on 149 out of 200 prints (74.5%), and Reader 2, on 179 out of 200 prints (89.5%). Both readers agreed on whether or not an angle was measurable on a print 89.8% of the time for the right hand and 78.0% for the left hand. Intra-observer correlations were 0.97 or greater for both readers. Inter-observer correlations for *atd* angles measured by both readers ranged from 0.92 to 0.96. Our results suggest that the *atd* angle can be measured reliably, and that angles measured using an angle measurement tool on a digital image improves reliability.

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An eye for an eye: the Anglo-Saxon execution cemetery at Walkington Wold.

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The cemetery at Walkington Wold, East Yorkshire, UK was located around a Bronze Age barrow, and contained twelve burials in various positions, many of whom were buried without their heads. In addition, eleven isolated skulls were

excavated. At the time of excavation (1969), the burials were interpreted as victims of a massacre that occurred in the 5th century AD (Bartlett and Mackey 1973), however more recently the site was re-interpreted as an Anglo-Saxon execution cemetery, of which examples are known from southern England (Reynolds 1997).

The cemetery contains a minimum of thirteen individuals, however only two of those were buried with their heads articulated with their bodies. Radiocarbon dates revealed that the cemetery was in use from the late 7th to early 11th centuries AD, and thus it is the most northern Anglo-Saxon execution cemetery identified to date. During this period burial was typically supine and extended, usually without grave goods and cemeteries were increasingly located around churches (Hadley and Buckberry 2005), quite unlike Walkington Wold.

Re-analysis of the skeletal remains showed that the assemblage consisted entirely of adult males, all of whom died between the ages of 18 and 45. Osteological evidence of execution by decapitation was present on six individuals, supporting the theory that these burials were of executed felons. This paper will present the palaeopathological evidence from the cemetery, and will interpret it in the context of normal late Anglo-Saxon burial practices.

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High inbreeding coefficient in an Indo-Costa Rican group.

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The topic of inbreeding has received attention from anthropologists because inbreeding might impact a population's level of genetic variation. Anthropologists are particularly interested in the inbreeding coefficients of small, isolated populations. In this paper, we report data on the inbreeding coefficient of a small ethnic group which has remained reproductively isolated until recently.

Since 2003 a team of cultural and biological anthropologists has been working with a group which descends from East Indian migrants in Limón, Costa Rica. We have complete genealogies of all individuals who belong to this group. We computed the inbreeding coefficient for each of these genealogies using the computer package DESCENT, kindly provided by Ed Hagen. Using the individual genealogies, we have obtained very high inbreeding coefficients: for two families, we have a 0.05 alpha. Reid (1973) lists several populations with this level of inbreeding, including several from India, the Hutterites, etc. We are working with our cultural anthropologist to link all of the genealogies into one, to better obtain a measure of α.

Our genealogical work shows that whereas this group remained isolated in previous generations, it has lowered its reproductive boundaries. Indeed, several of our subjects bemoan what they see as the inevitable disappearance of their group. Our genealogical data indicate that opening up the group to individuals from other ethnicities was inevitable, as the level of consanguinity was very high.

Child anthropometric comparison of two rural Costa Rican communities.

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The Monteverde region of Costa Rica has been increasingly effected by globalization changes over the last 30 years. Anthropometric and socioeconomic data were collected from the region in two settlements. The communities differ socioeconomically, one relying mainly on traditional agriculture, the other having made a transition to ecotourism. However, both communities are food-insecure.

The purpose of this paper is to determine if boys and girls are experiencing differently the process of nutritional change associated with their incorporation into the globalized market. The data cover information from 148 female participants (≥ 18) who were caretakers in a household of at least one child (age 7-12). For this paper, the main focus is that of the anthropomentric records of the children living in the households surveyed. The samples of boys and girls are comparable for age and sample size. Because the variances of both samples were not homogeneous, a t-test for unequal sample variances was performed. Our results indicate that boys and girls do not differ significantly for height (t= -0.54, df=137, p= 0.5893) and weight (t= -0.84, df= 138, p= 0.4047). Further analysis within the paper include comparisons between the two communities, and of adult and child anthropometrics.

Differential selective pressures at the CD36 locus among primates.

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The CD36 protein plays a role as a scavenger receptor and in cellular adhesion. This protein has also been shown *in vitro* to be a major receptor of the *P. falciparum* antigen PFEMP1. Studies have identified regions of CD36 that are specifically involved in the adhesion of *Plasmodium* parasites. Malaria, caused by members of the *Plasmodium* genus, is a major selective pressure in humans. Aside from humans, many other primate species harbor *Plasmodium* parasites. Here we examine the CD36 gene across a range of primates in order test for evidence of differential selective pressures on the distinct functional domains of this locus. Two main results are supported. First, there is evidence for differential selective pressures operating on the different functional regions of CD36. Second, different primate species show evidence for different types of selection. These results suggest that primates may be evolving to combat their *Plasmodium* parasites through modification of CD36. Additional explanations, based on the other functions of the CD36 protein, will also be explored.

A 3D morphometric analysis of Upper Palaeolithic hominin frontal bones from Russia and the North Caucasus.

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Claims have been made in literature that some of the Upper Paleolithic hominin fossils from Russia and the North Caucasus (e.g., Skhodnya, Podkumok and Khvalynsk) have Neanderthal features that may be representative of Neanderthal ancestry. This hypothesis is tested using 3D morphometric semi-landmark analysis and a comparative sample comprising 94 modern human and 26 Upper Pleistocene hominin (including 12 Upper Palaeolithic *Homo sapiens* and 9 Nenaderthal) frontal bones. The results do not support the hypothesis that Neanderthal features characterize these fossils. Rather, a distinctive suite of features separates Skhodnya and Khvalynsk from both the Neanderthals and modern humans. These features include a posterior position of bregma in relation to the stephanion resulting in a triangularly shaped coronal suture when viewed superiorly, a distinctive bregmatic and supraglabellar flattening and a relatively narrow supraorbital and temopral region. At the same time, some of the other Upper Paleolithic individuals in our comparative sample, such as Dolni Vestoniče and the Pavlov hominins, are characterised by relatively narrow and curved frontal bones when compared with modern humans, Neanderthals and the Upper Paleolithic hominins from Russia and North Caucasus. These results demonstrate that there is greater variation in frontal bone morphology in Upper Palaeolithic hominins than previously appreciated.

Are minor morphological variants indicative of developmental instability?

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Developmental instability is the result of perturbations of normal development from its course in producing a particular phenotype. Typically it is measured through the assessment of fluctuating asymmetry, defined as minor random deviations from symmetry in structures that normally exhibit bilateral symmetry. Increased fluctuating asymmetry has been linked to major congenital defects, syndromes, and inbreeding, among other factors. Rare minor morphological variants have also been suggested to reflect developmental instability due to the elevated rates of some variants in association with syndromes and congenital defects. The purpose of this study is to examine the relationship between post-cranial skeletal asymmetry and minor developmental variants of the human skeleton and dentition. Specifically this study tested the hypothesis that individuals with three or more independent variants exhibit significantly more skeletal asymmetry than individuals without skeletal/dental variants.

Thirty-six developmental variants from the skeleton and dentition were examined in the skeletons of 502 South African Bantu adults. In addition, 15 skeletal measurements were taken bilaterally to assess skeletal asymmetry. Measurements consisted of long bone lengths calculated for the metacarpals, metatarsals, humerus, ulna, radius, femur, and tibia. F tests (alpha = 0.05) were used to test for increased skeletal asymmetry in individuals with three or more independent variants relative to individuals without developmental variants.

Individuals with three or more variants did not have significantly greater skeletal asymmetry when compared to individuals without variants. These results suggest that developmental instability is not strongly related to the occurrence of multiple minor variants.

A bioarchaeological perspective on health, violence, and identity at Tchecar (AD 700-900), northern Chile.

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The San Pedro oases are located in the Atacama Desert of northern Chile. We examined 193 individuals from Tchecar (AD 700-900), a site occupied during a time of peace and affluence in the Atacama. Bioarchaeological data was collected regarding overall health and body modifications in order to assess quality of life during this prosperous time as compared to later, tumultuous, periods.

Our analyses show that cranial modification parallels that in contemporary cemeteries, with the presence of both of the major Andean forms and nearly a third of the population modified (63/193). We observed low rates of nutritional deficiencies (cribra orbitalia: 3/193; porotic hyperostosis: 1/193; enamel hypoplasia: 11/155) demonstrating access to a broad range of foods and a balanced diet. In contrast, dental health data show high rates of caries (100/190) and dental wear. Together with the very high rate of antemortem tooth loss in adults (148/161), this suggests high consumption of carbohydrates and foods ground with mortar and pestle. These data are in keeping with the idea that Atacameños practiced agriculture and pastoralism. Cranial trauma was centered on the nasal bones and was present in about 10% of the sample, all adults (21/193), suggesting that face-to-face confrontations, primarily between men, were a focus of violence in this society. These data reveal a population that was in good health outside of their dentition, especially compared to individuals from subsequent periods, and was well integrated into cultural practices of the time.

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Cranial suture morphology: understanding how dietary strategy and brain size influence primate craniofacial bone growth.

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Morphological variation in the craniofacial complex is useful for determining phylogeny as well as interpreting feeding behavior. However, some features are present due to the spatial consequences of altering inherited craniofacial characteristics either by changing the size of nervous system structures (optic, auditory, olfactory, brain) or by sexual dimorphism. Within cranial sutures, we have shown a form-function link between complexity and dietary strategy required through ecological niche specialization. Experimental mouse data demonstrate a positive relationship between masticatory muscle mass / function and suture lines of greater complexity. This is repeated by assessing sagittal suture morphology within a comparative primate sample. It is hypothesized that brain expansion and sexual dimorphism within the cranial vault and the material properties of an organisms' food preferences influence suture morphology. This is accomplished using a large sample of primates that have been measured with respect to general dietary preferences, sagittal suture complexity, sagittal crest presence, estimated temporalis attachment area, estimated cranial capacity, and mandibulo-dental dimensions. Cebus species subsisting on diets of differing material toughness (C. apella vs. C. albifrons) show changes in such morphologic variables as mandibular corpus cross-sectional area ($P<0.001$), mandibular ramus area ($P<0.001$), mandibular symphyseal cross-sectional area ($P<0.001$), molar occlusal surface ($P<0.001$), temporalis attachment area lateral to temporal line/sagittal crest (0.001), presence of temporal line/sagittal crest, and complexity of the sagittal suture ($P<0.05$). It can be concluded thus far that obdurate foods and increased muscle function help direct bone formation within the mandible and cranium of primate and mouse models.

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South American population genetic structure and history: the Y perspective.

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This study addresses the paternal genetic structure and history of South American peoples using data from the nonrecombining portion of the Y chromosome (NRY). Early characterizations of the continent's genetic structure assumed high heterogeneity among populations. Recent characterizations hypothesize an east-west continental divide in genetic variation, with the west (i.e., Central and Southern Andean populations) being considerably more undifferentiated and homogenous than the east (i.e., Amazonian populations). Researchers have proposed various explanations to account for observed patterns, including initial migratory "waves" into the continent, population expansions, and/or regional differences in effective sizes and gene flow. Unfortunately, relatively limited sampling of the continent's peoples has resulted in a still-obscure picture of the continent's actual genetic structure, as well as the demographic and historical reasons for that structure.

To further investigate the male ancestry of native South American populations, we sampled ca. 150 males from five Native American populations from the Peruvian Andes. We examined twenty biallelic and nine microsatellite NRY polymorphisms, determined Y haplogroup- and haplotype-based lineages, and estimated within-lineage diversities. We found a high frequency of Q-M3 (~80%), no C, and a low frequency of R-M207 (~15%) lineages. The

haplogroup distribution and diversity of male lineages among these and other published data support the hypothesis of an east-west geographic difference in male ancestry and/or evolutionary trajectories. We additionally address the still-debated issues of New World male founder lineages, as well as the timing and number of migrations into South American and into the New World in general.

Use of modern Arctic peoples in modeling past behaviors.

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Archaeologists rightly hesitate to use any living human group as a referential model for past human behavior: using living humans as replicas for extinct people, and reconstructing minute details of behavior. Nevertheless, modern Arctic peoples allow one to understand the selection pressures that mold human adaptation to extreme environments. Cold environments affect survivorship and health, and constrain population growth. Selection pressures operate through the general impact of high latitude, increased caloric intake, a rise in basal metabolic rate, and diets where carbohydrates are absent or seasonally rare. Sunlight is seasonally restricted, affecting calcium metabolism and vitamin D synthesis. It is necessary to engineer technology (clothing, shelter, and control of fire) to minimize cold exposure. Social organization and ranging and foraging strategies respond dynamically to this array of selection pressures.

Modern Arctic peoples may also yield insights into the way of life of fossil humans. If one assumes that biological substrates are similar, Arctic peoples could offer a template for the possibilities of the behavioral adaptations of fossil humans to cold environments. The first dispersal of genus *Homo* into temperate latitudes was associated with an ability to adapt to greater cold and seasonality than in tropical latitudes. Neanderthals existing in cold Eurasian environments are another fossil taxon whose behavioral adaptations might be explored through the use of a modern Arctic template, especially because data on stable carbon and nitrogen isotopes in collagen from multiple specimens shows that they lived in open habitats, and had a highly carnivorous diet (Bocherens et al. 2005. *J. Hum. Evol.* 49:71-87).

Subadult sex estimation from the auricular surface of the ilia.

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The determination of sex from subadult skeletons has long been thought to be a difficult if not impossible task, though many anthropologists have endeavored to identify sexually dimorphic traits in these skeletons. Weaver (1980) identified the elevation of the auricular surface as a sexually dimorphic trait in fetal and infant individuals below the age of six months, with females expressing a raised auricular surface and males a flat auricular surface. This study suggests a revised method for scoring auricular surface elevation, utilizing a five point ordinal scale to account for ranges in elevation. The reliability of this method for determining the sex of subadults is tested using thirty six individuals, from birth through age six, from the known age and sex sample from Christ Church, Spitalfields. Both the left and right auricular surfaces were scored separately and the test was repeated to determine the amount of intraobservor error and learning curve. Accuracies for the separate observations ranged between approximately 60 and 80 percent with accuracy increasing in the later observations, which indicated that a learning curve does exist for this method. Expansion of the methodology to a five point ordinal scale showed an increased accuracy of the method in individuals after birth, as compared to Weaver (1980). In addition, this study indicates that the methodology is applicable to subadult individuals of a broader age range.

Growth patterns in adverse environments.

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The triple-logistic pattern of human growth in linear dimensions is probably one of the most recognisable models within human biology. The fact that postnatal *somatic* growth occurs in three phases (infancy, childhood, adolescence) creates opportunities for the individual expression of this genetically controlled, but environmentally modified, phenomenon. The impact of the environment works to alter the duration and intensity of critical stages within the total process resulting in individual patterns that can differ radically from the general pattern. However, the constancy of the general pattern is so fixed that its presence in children is taken as a reflection of good health. Departures from that pattern are recognised as reflecting ill health. Thus reference charts of normal growth patterns have become part of the essential armamentarium of the pediatrician and community health worker and are used to rapidly identify children with either chronic or acute constraints upon their growth and, by implication, their health. Whilst the cessation of growth in response to an acute attack is uniformally dramatic the gradual response to chronic adverse stimuli is less easily predicted and interpreted. For example, in chronic scenarios the loss of centile position that precedes the eventual establishment of normal increments can be viewed as either a poor or a good growth response, as either maladaptive or adaptive, as either poor health or good health. This paper reviews such growth patterns in urban South African children exploring the relationship between environment and growth outcome.

Age-related changes in urinary gonadotropins among Turkana men of northern Kenya.

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Recent findings demonstrate widespread population variation in age-related testosterone decline among human males, suggestive of differences in reproductive function. However, little is known about population variation in gonadotropins and their potential determinants. In order to characterize age-related changes in the male reproductive axis, we analyzed urinary FSH and LH and estrone-3-glucuronide (E3G) and their relationship to anthropometric measures from 134 nomadic and 102 settled Turkana males, ages 20+. Earlier results suggest that the nomadic men are in negative energy balance, while settled men are in positive energy balance after a long drought.

Results indicate low levels of urinary LH and elevated levels of E3G compared to U.S. standards, while urinary levels of FSH are elevated only among the settled males. GLM models indicate significant effects of 10 year age groups and nomadic vs. settled residence on LH, but there are no significant age-related changes in urinary FSH. E3G increased significantly with age among the settled males only.

These results suggest that environmental fluctuation may have an important impact on male reproductive function. The age-related increase in E3G among settled men is similar that of western populations who also exhibit positive energy balance. Furthermore, the increased levels of FSH suggest increased stimulation of Sertoli cells with weight gain after a period of weight loss. More work is needed to determine if such increases in FSH can be linked to other aspects of testicular function as well.

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Static allometry, species discrimination and sexual dimorphism of guenons (Primates, Cercopithecinae): a

three-dimensional morphometric analysis of the skull.

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It is often assumed that morphological variation in guenons (*Allenopithecus*, *Chlorocebus*, *Cercopithecus*, *Erythrocebus*, *Miopithecus*) is relatively modest compared to other cercopithecine monkeys. However, comparative analyses investigating the morphology of most living species are uncommon. In this study, the form of the skull is analysed using three-dimensional anatomical landmark coordinates of 1237 specimens belonging to all species of guenons (except *C. dryas*). Males are on average 12-14% larger than females, and shape sexual dimorphism is evident and largely correlated to size differences. Interspecific differences in size are large and, unsurprisingly, allometric shape discriminates the smallest (*M. ogouensis* and *M. talapoin*) and the largest (*E. patas*) species. A very clear discrimination, using non-allometric shape variation, was, in contrast, less easy to predict for *C. aethiops*, whose morphological and genetic similarities with representatives of *Cercopithecus* has led several taxonomists to question its generic status. Similarity relationships are also investigated using species average shapes with separate sexes. Clusters are fairly congruent with traditional taxonomic groupings but often mirror size similarities and can thus be homoplasic. However, percentages of specimens correctly identified according to species using discriminant analyses (skull shape, separate sexes) suggest that size-related morphological convergence may be present but it is not large enough to prevent species discrimination. The correlation between the matrices of shape distances for the female and male average shapes is very high. Thus, despite a strong sexual dimorphism, similar interspecific phenetic relationships are suggested by females and males. This congruence is likely to be related to the modest divergence of static allometric trajectories (adults, pooled sexes) of most species.

Arboreal locomotion from a different angle: external forces during quadrupedalism with abducted limb postures.

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Arboreal primates traverse three-dimensional settings in which substrates and superstrates are positioned irregularly. As a consequence, they adopt a variety of limb postures during locomotion, often abducting limbs at proximal joints. Studies of external forces experienced by primates during simulated arboreal locomotion, however, typically examine a limited subset of the locomotor diversity that can be observed among free-ranging counterparts. While comparisons of arboreal and terrestrial linear locomotion have demonstrated that primates experience lower external forces during arboreal locomotion, likely due to compliant gait (i.e., greater limb flexion), the mediolateral (ML) component of the substrate reaction force (SRF) may reflect the degree of limb abduction (i.e., greater during terrestrial linear locomotion).

To investigate this, SRFs and the degree of limb abduction at shoulder and hip joints were recorded for 390 limb contacts of lemurids (*Eulemur rubriventer*). Individuals traveled along a wooden runway or linear pole, each with an instrumented segment, and the same pole, but with the instrumented section offset from the longitudinal axis of the pole. As the amount of offset increased, ML peak force magnitudes increased. At the greatest offset, magnitudes and directions of ML peak forces were similar to those observed during runway locomotion, despite a slower average speed. When the instrumented segment was offset to any degree, SRFs usually were medially-directed, unlike laterally-directed forces that have been observed during simulated arboreal locomotion on a linear pole. Mediolateral peak force magnitudes experienced during arboreal locomotion can be high, even exceeding those experienced during terrestrial locomotion.

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Bone cell dynamics of the premaxillary bone and its sutures.

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The premaxilla (Pmx) and its articulations have played a pivotal role in theories of tooth homology and the etiology of facial clefting. The present study examines evidence of bone cell activity in serially sectioned and stained slides from the heads of perinatal or infant callitrichids (2 *Callithrix jacchus*, 2 *Leontopithecus rosalia*, and 5 *Saguinus geoffroyi*). Sections were examined microscopically regarding the distribution of osteoclasts and osteoblasts along the osseous boundaries of the Pmx and its sutures with adjacent bones. Selected specimens were immunohistochemically evaluated for the distribution of osteopontin (OPN), which facilitates osteoclast binding.

In all species, most of the alveolar margins were OPN (+) with osteoclasts. Most other regions of the Pmx were osteoblastic in newborn *Saguinus*, or devoid of bone cell activity in *Callithrix* and *Leontopithecus*. OPN immunoreactivity and bone cell distribution revealed evidence of bone resorption along the margins of the body and nasomaxillary process of the Pmx, but only where it formed an osseous boundary of the anterior nasal opening. The maxillopremaxillary suture (MPS) and nasopremaxillary suture was osteoblastic in newborn and infant *Saguinus*. These sutures were devoid of bone cells in *Callithrix* and *Leontopithecus*, except adjacent to the canine region of the maxillary bone in *Leontopithecus*. The present study suggests some perinatal Pmx growth in all three callitrichids, but also local resorption that varied according the adjacency to the nasal fossa or maxillary canines. Although consistent with the view of sutures as passive growth sites, these findings illustrate species differences in perinatal osteoblast activity, particularly at the MPS.

What failed communication attempts tell us about the mind of the signaler; gestural communication in captive Bornean orangutans (*Pongo pygmaeus*).

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The study of non-human gesture is hindered by the difficulty of determining when an animal is signaling. Unlike vocalizations, gestures lack clear boundaries and overlap with other movements of daily living, so it is hard to tell when the function of a movement is mainly communicative. Nonhuman gestures can be identified as such by recipients' responses, however this approach fails to capture the complexities of the use of multiple gestures in a single signaling event - and, more importantly, includes no measure of the signaler's intentions. To address these problems, we examined gestural bouts made by 9 captive Bornean orangutans to conspecific recipients who failed to respond in any way. Our study focused on what alternative behaviors signalers exhibit in cases where initial communicative attempts have failed. When a recipient does not respond, gestures can be recognized by subsequent repetition or patterned modifications of the signal. Such modifications provide information about the signaler's goal and awareness of the recipient's attentive state. String lengths ranged from 2-9 gestural elements. The probability of a signaler performing another gesture in a string increased from the 1st gesture until the 4th gesture. Beyond that, the probability of giving up and ending the sequence began to increase. The time between gestures decreased as

the number of items in the sequence increased. When recipients did not respond to gesturing, signalers sometimes touched recipients and/or moved closer to them or into their visual fields. These findings indicate that orangutans have specific intended results for some of their gestures.

Species taxa, characters, and symplesiomorphies.

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Mayr's "Biological Species Concept" bases all species distinctions on the absence of a single shared character – the ability to interbreed. Yet the ability to interbreed is a plesiomorphic character, and thus we should not be surprised to find it shared between taxa that have diverged in other respects. Many mammalian groups definable as separate species on the basis of morphological, genetic, ecological or behavioral apomorphies retain the ability to interbreed with each other. Interfertility is not an all-or-nothing condition; rather, there is a continuum from taxa that are completely interfertile, through those with reduced fertility, those where only male hybrid offspring are sterile (Haldane's Rule), and those where few hybrid offspring are ever fertile, to taxa which cannot or do not interbreed. A survey of interspecific hybrids reveals that complete reproductive isolation is relatively slow to evolve among eutherians. In our sample of 86 intertaxic crosses involving species with generation lengths of ca. 4-5 years, the minimum time required for complete reproductive isolation was 1.4 My. "Bushy" classifications of the Hominina, which posit many paleospecies becoming reproductively isolated from each other over much shorter periods, seem correspondingly improbable. We follow Jolly (2001) in viewing hominin paleospecies as allotaxa, some of which may have at times exchanged genes. This shift represents an important theoretical breakthrough for paleoanthropology.

Skeletal kinship analysis of Danish skeletons using postcranial anomalies.

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Because many postcranial anomalies show clinical evidence of heritability, they have potential as markers of genetic relatedness. In order to investigate the utility of these anomalies in skeletal kinship studies, heritable postcranial traits were scored on 1020 medieval Danish skeletons divided into three samples, one from the St. Alban parish church in Odense (n = 219), one from the Gray Friar monastery in Odense (n = 362), and a reference sample (n = 439) representing an estimated population frequency for each anomaly. The reference sample is a random sampling of the better preserved skeletons from eight different medieval cemeteries around Denmark.

Trait frequencies were calculated for the cervical vertebrae, sacrum, upper limbs, hands, and feet. In order to identify genetic relatives, individual frequencies within the parish and monastery cemeteries were compared to the population estimate using Fisher's Exact Test. A significantly higher frequency in the parish or monastery cemeteries ($\alpha = 0.05$) would indicate the likely presence of a genetic lineage. The rarer the trait, the more likely it is that the individuals sharing the trait all belong to a single lineage. Analysis revealed possible lineages involving three individuals with bipartite scaphoid (2.0% of scorable skeletons) and eight females with MC3 styloid anomalies from the monastery (6.4%). Six males with talocalcaneal coalition (3.7%) from the parish cemetery also appear to belong to a lineage. These compare to population estimates from the reference sample of 0.0% for bipartite scaphoid, 0.7% for styloid anomalies, and 0.9% for talocalcaneal coalition.

Sexual dimorphism in root formation of modern human third molars: A preliminary investigation.

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Histological analyses of root extension rates (RERs) offer important insights into the eruption schedules of human and non-human primates. Few histological studies have utilized root dentine to establish longitudinal root development trajectories; even fewer studies assess development differences between the sexes. This is the first study to calculate RERs from modern human third molars and to provide RERs of M3s for any member of Hominoidea.

Longitudinal data on root formation were collected from the maxillary and mandibular M3 protocone and protoconid roots from 6 individuals (3 males, 3 females). Midline longitudinal sections (ca. 100µm; n=28) were prepared according to well-established protocols and analyzed using transmitted polarized light microscopy. Using digital montages, measurements were collected in 1000 µm intervals for the initial 3 mm of root. Data consist of linear distances of both dentine tubules and accentuated Andresen lines at their point of intersection at multiple points within each 1000µm root segment. Two secretion rates (2.3 and 2.8 µm/day) were used to compensate for variable rates along tubules. No sex differences in RERs were found for any part of the mandibular M3 root (p=0.7389). Maxillary roots, however, show slight but significant differences in RERs, where males exhibit higher RERs (p=0.019). These results highlight subtle differences in root formation rates between arcades that ultimately may play an important role in establishing dental development differences between the sexes. Future research will test whether gender differences in root development are based on ontogenetic changes in RERs or ages at root initiation, or both.

Traumatic injuries in a skeletal collection of Red Colobus (*Piliocolobus badius preussi*).

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Trauma is described in longbones from a skeletal sample of *Piliocolobus badius preussi* housed at the Powell-Cotton Museum, Birchington, Kent, UK. Collected in the 1930s, they represent specimens from a time prior to a great deal of human/primate interaction in west central Africa. Frequencies of healed traumatic fractures have not been described for wild populations of this species from Cameroon. The data presented here will allow for a better understanding of the types of trauma that are survivable. Observations are made on the humeri, radii, ulnae, femora, tibiae, and fibulae for 28 individuals (7 males, 21 females). The type of trauma is characterized, and frequencies are calculated based on both sex and bone(s) involved. The fracture frequency is 29% for males and 19% for females. Both males and females sustained severe traumatic injuries with the majority of injuries to the femur (83%). Several complications are observed associated with the trauma, including traumatic myositis ossificans, pseudoarthrosis, and traumatic arthritis. Possible causes of the high frequency of trauma observed are also discussed.

Primate evolution in Southeast Asia.

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The phylogenetic and biogeographic history of many Southeast Asian taxa is poorly understood. This is partly due to a sparse fossil record and a limited understanding of the environmental history of the area. Here a range of taxa from the following Southeast Asian genera were selected for study: *Loris*, *Nycticebus*, *Macaca*, *Pygathrix*, *Rhinopithecus*, *Nasa-*

lis, *Semnopithecus*, *Trachypithecus*, *Presbytis*, *Hylobates*, *Bunopithecus*, *Symphalangus* and *Nomascus*; with *Lemur*, *Eulemur*, *Varecia*, *Pongo*, *Gorilla*, *Pan* and *Homo* employed as outgroup taxa.

Published molecular data from a range of genetic loci were analysed in both single gene and multiple gene phylogenetic analyses, in independent and combined reconstructions, using likelihood, parsimony and neighbour-joining methods. Resultant phylogenies were incorporated into cladistic biogeographic analyses, using a range of techniques including Parsimony Analysis of Endemicity and Component analysis, to reconstruct the biogeographic history of these taxa. The congruence between these analyses was tested, to predict their patterns of radiation across mainland and archipelagic Southeast Asia. Molecular clock analyses, conducted in the BEAST program, were used to estimate the timings of these radiations. The resultant biogeographic trees were interpreted in light of current hypotheses regarding the environmental history of the area, and the results of the analyses were combined to provide a new interpretation for the phylogenetic and biogeographic history of primates in Southeast Asia.

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Environmental dynamics on an evolutionary time scale can shape the genetic basis of an organism's adaptability: Insights from the mighty worm (*C. elegans*)

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Adaptability involves an organism's ability to endure novel environments. Paleoanthropological investigations of the hominin fossil record suggest this ability became increasingly evident in the evolution of *Homo*. The processes by which adaptability may evolve, however, are largely unknown. One hypothesis is that environmental dynamics at diverse temporal scales (generational time) may have some critical effect in shaping the genetic basis of an organism's adaptability.

The well-characterized model organism *Caenorhabditis elegans* (nematode worm) has a generation time of three (3) days and is easily maintained in large populations. Hence, this organism is ideal for testing our hypothesis on an evolutionary time scale. Empirical observations show that *C. elegans* grown at temperatures above 25°C have significantly reduced numbers of progeny and levels of fecundity compared to worms grown within normal culture temperature range of 16-25°C. We propagated worm lines for 110 generations and measured the response (progeny number) to an environmental sequence of initial temperature selection, non-selection, and secondary temperature selection.

The results of this study provide two conclusive findings: (1) A population that experienced a prior episode of temperature selection adapts more quickly than a naïve one and (2) A distinct difference in timing of progeny production exists in selected vs. non-selected individuals.

The implications of this work for understanding the evolution of adaptability in organisms, with focus on *Homo*, will be discussed.

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Unexpected declines in luteal uterine endometrial thickness in healthy rural Polish women aged 20-40 years: implications for population variation

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Endometrial thickness may be responsive to ecological factors and prove to be a crucial measurement in the study of reproductive ecology and human biological variation. Although endometrial thickness is commonly thought to be relatively invariant or increase slightly over the luteal phase, previous pilot investigations have revealed significant individual variation. However, population variation remains largely unexplored. In this investigation, endometrial thicknesses in healthy rural Polish women (29±5.3yrs, n=26) were measured using transvaginal ultrasound between days 16 to 24 of their cycle in order to determine whether significant hypothesized population variation was evident. Contrary to expectations based on the clinical literature, endometrial thickness decreased significantly as the cycle day of the ultrasound increased (r^2=0.13, p=0.07; results when ET values averaged for each day: r^2=0.75, p=0.005). This suggests several possibilities: these data provide negative results for the two current hypotheses of how the endometrium varies across the menstrual cycle, the change in the endometrium over the menstrual cycle varies across populations, or these data show previously undescribed plasticity in endometrial function in response to different ecological conditions. Continuing work will investigate specific contributory factors such as energetic intake and expenditure, insulin levels, parity, and salivary estradiol and progesterone concentrations.

Chimpanzee mitochondrial DNA diversity.

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The ancestral *Pan* and *Homo* lineages diverged about 6 million years ago, and *Pan troglodytes* (chimpanzee) and *Pan paniscus* (bonobo) diverged approximately 1-2 million years ago. The isolation of chimpanzee groups by changes in forest distribution and river topography over time resulted in the evolution of three widely recognized subspecies of *P. troglodytes*: *P.t. schweinfurthii*, *P.t. troglodytes*, and *P.t. verus*. Previous analyses of chimpanzee mitochondrial DNA (mtDNA) sequences have shown that each subspecies can be identified by specific mtDNA lineages. Through mtDNA hypervariable region I (HVI) sequencing, the subspecies of 239 individuals were identified through comparison to sequences of chimpanzees of known subspecies. HVI sequence analyses were used to study inter- and intra-subspecies relationships and population histories. Chimpanzees as a whole had greater mtDNA diversity (π = 0.078) than bonobos (π = 0.039) and humans (π = 0.026). *P.t. schweinfurthii* had lower levels of mtDNA diversity (π = 0.025) than the other two subspecies (*P.t. troglodytes* π = 0.045 and *P.t. verus* π = 0.051). The tentative subspecies *P.t. vellerosus* has a level of mtDNA diversity (π = 0.036) that falls within the range of the other subspecies. Recent analyses have shown that chimpanzees have lower levels of Y chromosome compared to mtDNA diversity. *P.t. verus* has the highest levels of mtDNA nucleotide diversity but lowest levels of Y chromosome diversity (based on previous studies) than the other subspecies, which suggests that demographic histories differ between subspecies.

Teeth as part of the hominid tool kit: tooth wear patterns in Neanderthals and early modern humans

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Tooth wear is traditionally recorded using ordinal methods that place degrees of wear into discrete categories. Whilst quick to apply these methods can be highly subjective and have the statistical restrictions associated with non-continuous data.

This paper presents the results of a quantitative tooth wear study of Neanderthals and early modern humans. Tooth wear was measured from digital photographs using a computer software programme and a graphics tablet. The occlusal area of each tooth was calculated as well as the area of dentine. To calculate the ratio of wear, the area of dentine was

divided by the area of the occlusal surface. This method overcame the many problems connected with ordinal techniques. It also enabled the identification of subtle differences in tooth wear patterns within and between groups of Neanderthals and early modern humans.

These results were then compared to the tool technologies associated with different chronological and regional groups of Neanderthals and early modern humans.

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Comparative analysis of two techniques to measure dietary preference in *P. ursinis*: ethological observation and dental microwear.

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Dietary observations on wild primates rarely report the corresponding dental microwear scars due to the endangered status and difficulty of capturing large primates. Meanwhile efforts to reconstruct past diets depend on the diet signal obtained from living primates. To address both of these concerns, a categorization of dietary preferences of *Papio ursinus* was compiled using behavioral observations at the Cape Peninsula, Table Mountain National Park, South Africa. The herbaceous and invertebrate materials consumed by *P. ursinus* during the observational study were cataloged and quantified for comparison to the diet signal preserved on dental impressions from wild-caught *P. ursinus* specimens (n = 27) from the Cape region housed at the South African Museum. Casts from these dental impressions were compared to those obtained from folivores (*Alouatta*, *Colobus* and *Procolobus*), frugivores (*Pan* and *Pongo*), gramnivores (*Theropithecus*) and hard object feeders (*Cebus*) using low magnification stereomicroscopy. Pits and scratches were quantified and described on the paracone of the second molar of each specimen using a 0.4 mm by 0.4 mm ocular reticle, calibrated at 35x, as a sampling strategy. *P. ursinus* revealed multiple flake pits and hyper-coarse scratches suggestive of a heavy grit load and substantial hard object feeding. This dental microwear signal corresponds to the behavioral data collected on free-ranging *P. ursinus* in the Cape region. During the winter season, when food resources in this fynbos-dominated ecosystem are particularly scarce, *P. ursinus* is forced to rely on tubers, rhizomes and restiose seeds, that leave the unique dietary signal of a mixed/hard object feeder.

Model-based estimation of variance-covariance structure in landmark data, with a consideration of morphological integration in the *Macaca fascicularis* cranium.

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Measurement of phenotypic variances and covariances (VCV) is central to the study of how complex organisms grow, adapt, and evolve. We address the question of VCV estimation from landmark coordinate data. While we can currently use method-of-moments techniques to estimate singular versions of among-landmark VCV matrices, methods for estimating full-rank matrices have not yet been developed. Importantly, full-rank matrices are necessary both to interpret VCV structures in anatomical terms and to make meaningful comparisons across taxa.

We propose a new technique that uses theoretical models of morphological integration, in conjunction with singular VCV estimates, to produce biologically credible, statistically consistent, full-rank estimates of phenotypic VCV structure. Given a singular VCV estimate and a matrix-valued integration model, we can constrain and uniquely solve a system of simultaneous linear equations, yielding a full-rank VCV estimate. Because we get different estimates under competing models, we have developed a test to determine which of the full-rank VCV estimates from the models we evaluate best fits the data.

As an example, we study 11 cranial landmarks from 48 adult male *Macaca fascicularis*, covering the neurocranium, basicranium, and face. We consider a series of different theoretical models predicting the "adjacency" of landmarks in terms of shared developmental history (e.g., ossification mode, mesodermal vs. neural-crest origin), participation in common functions (e.g., mastication, respiration, encasing the brain), and spatial proximity. We conclude by demonstrating how VCV structure can be visualized and by outlining some important methodological limitations on landmark-based studies of morphological integration.

Predicting auditory sensitivity from ear morphology in Primates.

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Primates express numerous modifications on the fundamental mammalian ear morphology and these differences have proven useful for phylogenetic classification at various taxonomic levels. However, the functional implications of the variation in primate auditory structures are not well understood. A better understanding of how variation in ear structure is related to differences in hearing sensitivity will shed light on the sensory adaptations of extant primates and their fossil relatives.

This study measures a suite of morphological traits of the ear in a wide taxonomic sample of primates and compares these structures to measures of hearing sensitivity. The list of measures on auditory structures includes the external dimensions of the pinna, tympanic membrane and stapedial footplates areas, lever arm lengths of the malleus-incus complex, mass of all three auditory ossicles, linear measurements of ossicular processes, volume of the tympanic cavity and all related diverticuli, and length of the basilar membrane. Hearing sensitivity is evaluated by measuring various parameters of primate audiograms such as high and low frequency limit, frequency of greatest sensitivity, and area of the auditory curve.

Relatively high correlations are found between individual and groups of structures and particular hearing patterns. For example, tympanic membrane area and tympanic cavity volume are strongly related to low frequency sensitivity while ossicular mass does a good job of explaining high frequency limit. The relationship between lever arm ratios and maximum sensitivity is complex but appears to agree with acoustic theory when examined within suborders. These findings set the stage for predicting hearing sensitivity in fossils.

An assessment of the taxonomic status of the hominid femora KNM-ER 1481A and KNM-ER 1472.

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It is widely accepted that the femora KNM-ER 1481A and 1472 are early representatives of the genus *Homo*, but discussion continues as to which species of *Homo* they should be assigned. According to some researchers they represent *Homo rudolfensis* since they were found at the same site as the type specimen of this species, KNM-ER 1470. According to others, at least one of the specimens, KNM-ER 1481A, has features that link it with *Homo erectus*. Still others have argued that KNM-ER 1481A should not be attributed to *H. erectus* but only to archaic *Homo*, because the features that have been suggested to link it with *H. erectus* do not in fact allow discrimination at the species level within *Homo*.

In the study reported here we used bootstrapping methodology to test the

hypothesis that KNM-ER 1481A and 1472 cannot be distinguished from non-*erectus Homo* femora at p≤0.05. Eleven measurements were taken on KNM-ER 1481A and 1472 as well as on samples of extant great apes, modern humans, and a range of fossil hominid femora including specimens that have been assigned to *Australopithecus, Paranthropus* and *Homo*. From these measurements distributions of differences between intra-specific pairs of great ape and modern human specimens were generated on the basis of size-corrected average taxonomic distance. The distributions were then used to assess the significance of the differences among the various fossil hominid femora. The results of these analyses indicate that KNM-ER 1481A and 1472 cannot be distinguished from non-*erectus Homo* femora.

Anthropoid masticatory adaptations to hard and tough diets.

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In trying to reveal masticatory adaptations to diet, past studies have searched for correlations between skull morphology and broad dietary categories such as 'frugivore' or 'folivore.' But the complexity of most primate diets is not captured by these categories. The current study examines diet from the perspective of food material properties. More specifically, it seeks to determine if foods classified as "hard" or "tough" have a consistent and predictable effect on the skull morphology of primates. This is different from traditional approaches in that it recognizes that it is the material properties of foods that determine the levels of stress and strain in the masticatory apparatus. Thus, these properties may be more closely tied to morphology than broad categories of food type.

Both Old World (*Macaca*) and New World (*Cebus*) monkeys were compared using geometric morphometrics to determine if the species within each genus that eat the hardest or toughest foods feature biomechanical adaptations for doing so. Masticatory traits were considered to be adaptations for consuming hard or tough foods if they either increased the mechanical advantage of the masticatory system, or decreased the stress or strain placed on the system. The results show that *Cebus apella* and *Macaca sylvanus* are both adapted for eating mechanically demanding foods relative to the other members of their respective genera. *Macaca fuscata* also shows similar adaptation in the mandible, but contrary to predictions, it has a narrower face than the other macaque species.

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Capable hands: Osteoarthritis, activity patterns and the sexual division of labor.

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Patterns of Activity-Induced Pathology in a Canadian Inuit Population remains the best example in our literature of task-related modifications in the skeleton. Its success reflects its grounding in the rich ethnographic literature on Inuit peoples and the physical demands posed by their strenuous way of life. Merbs was forced to omit hand phalanges from his study because of poor recovery and difficulty in assessing side and ray.

Tasks involving forceful repetitive use of the fingers are among the most gendered in traditional societies. Weaving, spinning, sewing, sorting of seeds, milking, writing, and flint-working are among the tasks of interest. Apart from Merbs' identification of sex-specific wrist arthritis patterns linked to kayak paddling and leather working, most literature on activity-related modification of the hand is anecdotal. Both Kennedy and Angel have focused on flexor tendon attachments in the hand phalanges, the former with regard to writing and the latter with regard to weaving. Grip strength and strain gage data on subjects performing the tasks listed above are used to assess these interpretations. The resulting model is applied to a comparison of sexual dimorphism and asymmetry in early 20th century cadaver hands.

The phylogenetic position of the Victoriapithecidae.

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The Victoriapithecidae is a family of African cercopithecoids whose taxonomic placement has been much argued in recent years. The family currently comprises two genera and three species: *Victoriapithecus macinnesi, Prohylobates tandyi,* and *Prohylobates simonsi*. *Victoriapithecus* is by far the best known of these taxa, largely due to the extensive collection from Maboko Island, Kenya, mainly recovered by B. Benefit and colleagues. The Maboko specimens date to the mid-Miocene and show a number of conservative features including incomplete bilophodont dentition and a small cranial capacity. The victoriapithecids have most often been placed as the sister group to the Cercopithecidae, especially by Benefit, and it has been hypothesized that colobine and cercopithecine monkeys evolved from this victoriapithecid stock. However, the victoriapithecids share several cranio-dental characters with the cercopithecines to the exclusion of the colobines, so an alternative interpretation is that the "victoriapithecids" may be stem cercopithecines. This study evaluates that hypothesis.

Over fifty quantitative and qualitative cranio-dental characters of extant and fossil cercopithecines, colobines, and early catarrhines were considered. Quantitative data were taken using calipers. Results indicate close phylogenetic affinity between *Victoriapithecus* and the cercopithecines, separate from the colobines. In light of this finding, it is suggested that *Victoriapithecus* and relatives can no longer be accepted without question as a separate family within the Cercopithecoidea. A more detailed reanalysis of all known data is required to adequately choose between the two well-supported alternative hypotheses of relationship.

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Sacred elements: assessing Byzantine pilgrimage to Jerusalem using elemental and isotopic composition of human bone.

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Elemental and isotopic analysis of bone was conducted as part of an investigation of migration (pilgrimage) to a Byzantine (5th-7th C) monastic community in Jerusalem. Fifty-four adult left proximal femoral shafts were sampled. Sex was determined using femoral head diameter and linea aspera robusticity, with the majority of individuals illustrating decidedly masculine features. Samples were analyzed for Ca, Sr, P, and Ba using an Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES). A mean Ca/P ratio of 2.1:1 indicated good bone mineral preservation. The $\log_{10}$(Ba/Ca) and $\log_{10}$(Sr/Ca) were calculated according to Burton (2003) to determine whether the individuals at St. Stephen's monastery were from the region or of non-local origin.

The adult samples were also analyzed for stable strontium isotope content ($^{87}Sr/^{86}Sr$). Strontium is incorporated into the hydroxyapatite crystal due to its chemical similarities to calcium. Different geographic regions have distinct geochemical profiles with relatively unique $^{87}Sr/^{86}Sr$ isotopic ratios. Thermal Ionization Mass Spectrometer (TIMS) was used for this phase of the analysis. These data, combined with dental metrics, and cranial, dental, vertebral, and femoral nonmetrics demonstrated considerable homogeneity in all these features for the monks in this urban community. Although his-

torical records for the region and period describe pilgrimage to the "Holy Land" as a major social phenomenon in the 5th-7th centuries, Jerusalem's largest monastic compound seems to have drawn its members from the surrounding environs.

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Does osteopenia play a role in the morphology of the Eskimo femur?

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The Tigara and Iputiak populations from Point Hope, Alaska present a fascinating case study for anthropologists interested in skeletal adaptations to cold climates. While much ink has been spilled on the subject of nose size and shape in relation to climate, less work has been done on the geometry of long bones. When compared to American whites (n=247) and blacks (n=42) in the AMNH collection, the Point Hope individuals (n=231) show several statistically significant differences. Overall, the Eskimo femur is both short and stout with thin cortical walls. The increased diameter of the femur offsets its thinner cortex in maintaining strength and stiffness. More precisely, increased strength in resolution of torsion and axial loads is accomplished with less cortical area as girth expands relative to length.

We propose that the geometry of the Eskimo femur helps to maintain strength and rigidity despite a thinner cortex, less dense bone and less bone volume. Eskimo coxofemoral geometry increases skeletomuscular advantage through proportions, girths, angles and torsions amenable to the reduction of joint loads and associated skeletal stress.

Other attributes of the geometry of the Eskimo femur also appear conducive to the reduction of skeletal stress and joint reaction forces and infer mechanical advantage and strength. These include relative head size, shape, length, angle and rotation of the femur neck, platymeria, orientation at mid shaft, bowing, carriage angle and a strong and prominent pilaster. We propose these changes are due to osteopenia and climate adaptation.

What the Moche Giants didn't have: a medical evaluation of potential causal agents.

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Between 1997 and 2000 a unique archaeological discovery was made at Dos Cabezas, Peru. This ancient city was built during the first centuries AD by the Moche people of the north coast. Excavations in the main pyramid at the site uncovered four high status tombs, within which were the remains of five young elite males. All exhibited unusual skeletal pathologies, including abnormally tall stature. These five "Giants" are the first such individuals recorded in the hemisphere. In our investigations of possible causal agents we have considered and evaluated Pituitary Gigantism, Marfans syndrome, Parahyperthyroidism, Thalassemia, Gaucher's disease, Nieman-Pick's disorder, Ehlers-Danlos syndrome, Homocystinuria, and McCune-Albright syndrome. All have been rejected. Examination of the Giants' pathologies and the reasons for dismissing the proposed diagnoses are discussed.

The positional behavior of the Tonkin snub-nosed monkey (*Rhinopithecus avunculus*) at Du Gia Nature Reserve, Ha Giang Province, Vietnam.

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The Tonkin snub-nosed monkey (*Rhinopithecus avunculus*) is recognized as one of the 25 most critically endangered primates in the world. Endemic to Vietnam, it is presently known only from three locations: Na Hang, Cham Chu, and Du Gia nature reserves. During the past year our team has spent approximately 12 days per month collecting data on this species at Du Gia. In contrast to the three Chinese snub-nosed monkey species, the Tonkin snub-nosed monkey is an arboreal specialist that rarely, if ever, comes to the ground. Locomotion is primarily palmigrade symmetrical gait walk (pronograde quadrupedalism) but also includes frequent leaping and armswinging. Pronograde and brachiating leaps are commonly used to cross openings in the canopy. During feeding and resting, animals commonly use a sit/forelimb suspend posture. In addition, when feeding on small substrates, animals have been observed using a forelimb/hindlimb stand posture. While these data are preliminary in nature, it appears that like other odd-nosed monkeys, the Tonkin snub-nosed monkey uses suspensory locomotion and postures more frequently than do other Old World monkeys.

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Postcranial growth and development of immature skeletons from Point Hope, Alaska.

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The relatively large sample of immature remains from the site of Point Hope, Alaska represents a unique opportunity to examine patterns of postcranial growth and development in a population primarily engaged in a hunting subsistence economy. This study examines several aspects of limb growth, particularly the development of postcranial robusticity and ecogeographic body proportions throughout ontogeny, in the immature skeletal remains from Point Hope. Midshaft cross-sectional properties of the femur, humerus, and tibia, along with limb indices, were compared between three samples: Tigara and Ipiutak period subadults from Point Hope, Alaska (N = 70); Indian Knoll Archaic subadults (N = 110); and urban and rural South African subadults from the Dart Collection (N = 96). The results of this analysis indicate that differing patterns of cross-sectional robusticity emerge relatively early in ontogeny in these three samples. In addition, differences in ecogeographic limb proportions are clearly apparent in the immature remains from South Africa and Point Hope. While differences in body proportions between these three samples are likely genetically based, the early appearance of contrasting levels of limb robusticity may result from differing patterns of mobility and upper limb use during childhood.

Origins of Aleut populations: Molecular perspectives.

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Molecular and demographic studies were initiated in 1999 to determine the Siberian origins of the inhabitants of the Aleutian Islands and their role in the peopling of the Americas. To date, more than 460 persons from eight islands of the Aleutian archipelago (Atka, Bering, King Cove, Sand Point, St. George, St. Paul, Unalaska, and Umnak) have been sampled for mtDNA variation. A sample from Bering Island has been analyzed for STR variation. RFLP analyses and sequences of the HVS-1 revealed the presence of two of the five founding Native American haplogroups, A and D. Haplogroup D occurred at a high frequency in Aleuts, distinguishing them from Eskimos who have a high frequency of A and a subtype A4 defined

by np 16265 A→G transition. AMOVA analysis revealed the persistence of population structure along an east-west axis, concordant with both linguistic and archaeological evidence. The Aleuts share two haplotypes A3 and D2 with Native American and Siberian populations and exhibit one haplotype specific only to the Island populations, namely A7 (16212A transversion). Median network analyses reveal that the Aleuts are most closely related to the Chukchi and Siberian Eskimos, but differ from Alaskan Eskimos. Mismatch distribution for the total Aleut population is bimodal with mutation peaks at 0 and 7. However, mismatch reanalysis of the Aleuts subdivided by the three haplotypes is suggestive of a dual expansion of the Aleuts. The A and D clusters indicate that the Aleuts separated from the Eskimos approximately 6000 years bp.

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An investigation of secular change in the craniofacial morphology of White and Black males and females in the United States.

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Secular changes in the human skeleton have been of interest to anthropologists for almost a century. While short-term or generational microevolutionary changes are considered the result of environmental conditions acting on growth and development, longer temporal trends are typically deemed the result of a combination of both environmental and genetic factors. Plasticity in craniofacial morphology remains one particular area of interest and documented investigation. In this study, four craniofacial angles and indices of 19th Century and modern Americans are examined for evidence of secular change utilizing a sample (n = 685) of craniometric measurements compiled from the Terry Collection, the Hamann-Todd Collection, and the University of Tennessee Forensic Data Bank.

Each of the four mid-facial angles examined, Simotic angle, Zygomaxillary angle, Nasio-frontal angle, and the Dacryal angle are calculated from pairs of established craniometric measurements as defined by W. W. Howells. As additional analysis, craniofacial indices corresponding to the above mid-facial angles are also calculated. Evaluation of secular changes executed by statistical regression of the cranial variable on year of birth indicates a negative trend or reduction in craniofacial angles discernible as a narrowing of the mid-facial region.

Observable non-metric cranial characteristics continue to be relied upon as a fundamental technique for ascribing ethnic affinity to skeletal remains. Increasing evidence of secular changes should signify that such characteristics are not "fixed" and attention must be given to the collection and utilization of metric data from both bioarchaeological and forensic remains for future temporal studies and subsequent methodological improvements.

Allomaternal care among the Hadza of Tanzania.

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Previous research demonstrates that the presence of allomaternal care may positively affect the reproductive success of the recipient mother (Bereczkei and Dunbar 2002, Crognier et al. 2001, Flinn 1989, Hames and Draper 2004, Hrdy 2005, Ivey 2000, Sear et al. 2000, 2003, Turke 1988). A number of individuals may provide direct care and/or caloric provisioning to dependent offspring, possibly lessening a mother's energetic and nutritional burden during costly stages of reproduction (Hawkes et al. 1989, 1997, Hill and Hurtado 1996, Ivey 2000, Marlowe 2001, 2003).

The current study provides data on allomaternal assistance among the Hadza of Tanzania. The percentage of time an infant or child under four years of age is held by an individual other than the biological mother is used as a measure of direct care. Camp scan data collected during a total of 53 days from August – September 2003 and December – January 2004 are used to determine the frequency in which dependent children are held by allomothers. Our results indicate that Hadza children receive a substantial amount of allomaternal care, reflecting a child rearing system in which various classes of allomothers (related and non-related) provide direct assistance to the recipient mother. These data suggest that among the Hadza, allomaternal care may be one type of low-cost assistance that influences parental investment tradeoffs and increases a mother's reproductive success. Research on the precise role of allomaternal assistance in cooperative breeding among humans adds insight into the evolution of human life history.

Support: National Science Foundation

Child growth as a measure of livelihood security: the case of the Gwembe Tonga.

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Anthropometric measures of child growth have long been used by international, national and local health organizations to assess the well-being of populations. Where children fail to "measure up" to international references of height, weight, and/or arm circumference, they are considered "undernourished" and the causes of growth deficits are sought in circumstances of health and nutrition. Through the theoretical lens of human adaptability, biological anthropologists have contributed much to this work, especially as it relates to how humans negotiate their environments and the consequences for adaptive outcomes. More recently, many biological anthropologists, or biological/cultural anthropologist teams, have been investigating the roles of social location and political-economy in resource acquisition, with consequences for growth outcomes. This approach requires a broader perspective on environment and attention to community, household and/or individual strategies for gaining access to resources however limited and/or constrained.

In this paper, we outline a theoretical approach and research methodology that consider the relationship between livelihood strategies and anthropometric outcomes among Gwembe Tonga migrants in Southern Province, Zambia. We use measures of child growth to ascertain the success of diverse and multiple livelihood strategies of two generations of families who have negotiated, and continue to negotiate, the challenges of shifting environments resulting from forced displacement from their homeland in the 1950s, and a subsequent, secondary migration to a frontier zone further north in the 1980s.

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A summed segment analysis of bipedality: Implications for hominin dispersals out of Africa.

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Human bipedal walking is a whole-body activity. To effectively model hominin locomotion a segmented model must be used to account for differences in movement throughout the body. Using segment surface areas and 3D motion capture data of walking modern humans, segment displacements and thermoregulatory responses in varying environments were estimated for several fossil hominin species.

The lower energetic cost of arms compared to that of legs, the limited cost of swinging the arms during gait, the fact that the arm segments are the most capable of dissipating heat due to their SA/M, sweat gland recruitment patterns, and greater rates of displacement during normal walking, all strongly suggest that the evolution of bipedality has been influ-

enced by the thermoregulatory benefits of arm swing during normal locomotion. Early hominins may have retained a more *Pan*-like body morphology after the adoption of habitual bipedality because it provided thermoregulatory advantages without the energetically costly gain of mass associated with increases in leg length. Factors other than, or in addition to, long distance bipedal walking must be responsible for the dramatic postcranial changes seen in the Plio-Pleistocene hominins.

This study found no clear energetic-based reason why hominins possessing primitive body morphologies should not be expected off the African continent either prior to, or after, *H. erectus/ergaster*. However, these data do indicate that a biped with a modern human body morphology would be less sensitive to ambient temperature changes and would be able to safely exploit a greater range of environments.

A review of the clinical literature and skeletal alterations associated with iron deficiency anemia: is the postcranial skeleton affected?

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The relationship between iron deficiency anemia (IDA) and skeletal lesions is addressed in both the clinical and anthropological literature. There is a general consensus that the symmetrical sieve-like porosities of the frontal and parietal bones, together with widened diploe (porotic hyperostosis), have an anemic origin. However, the responses of the postcranial skeleton to iron deficiency remain elusive. Isolated clinical studies conducted during the 1960s and 1970s claim patients with IDA have both cranial and postcranial skeletal alterations. Two key questions are addressed. First, is the diagnosis of IDA supported by the patient's hematologic profile? Second, in justified cases of IDA, are postcranial abnormalities the direct result of the hematologic disorder?

An evaluation of eleven clinical studies, commonly cited in the anthropological literature, which suggest a relationship between IDA and skeletal lesions is presented here. Laboratory results of a combined total of 149 patients are evaluated against current cutoff values for major laboratory parameters, such as hemoglobin, hematocrit, serum iron and ferritin.

In all patients exhibiting postcranial skeletal abnormalities (n=117), the clinicians failed to either unequivocally establish the diagnosis of IDA through laboratory results or attribute the lesions primarily to IDA. In many cases, patients may have suffered from a variety of disorders including the anemia of chronic disease, protein energy malnutrition, genetic anemia, and primary or secondary iron deficiency. The results of this review demonstrate the cause of postcranial lesions should not be attributed to IDA and that greater caution is necessary in the interpretation of clinical data.

Variation in dental eruption in wild ring-tailed lemurs (*Lemur catta*) at Beza Mahafaly Special Reserve, Madagascar: Implications for understanding lemur life history.

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Patterns of dental eruption provide an important indicator of primate life history. Because of the difficulties inherent in collecting data on dental development in wild primates, much of the available information on primate dental eruption comes from captive studies or skeletal samples. Here we present data on dental eruption in a population of wild ring-tailed lemurs from Beza Mahafaly Special Reserve, Madagascar. As part of our comprehensive study of this population, across three field seasons (2003-2005), we collected data on dental eruption from 23 subadult individuals (2nd year cohort, minimum age of 18 months), determined by body mass, sexual maturity, and absence of a full adult dentition. At a minimum age of 18 months, 11 of 23 subadults had not yet experienced gingival emergence of the adult maxillary canines. This contrasts with published data for ring-tailed lemurs, in which adult maxillary canines are reported to emerge at 15 to 16 months. Also, two of the 23 individuals examined exhibited "delayed" emergence of adult P_2 (not yet emerged or having just emerged). Although we have witnessed less mating synchrony than previously reported for ring-tailed lemurs, asynchronous reproduction does not account for later eruption of the adult maxillary canines in our sample, compared with captive ring-tailed lemurs. This suggests that *Lemur catta* exhibits slower dental development than previously understood, and indicates that observable, individual variation in dental eruption can occur in a single lemur population.

Genetic factors in physical growth and development.

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Diminished growth during childhood can be viewed as either an indicator of environmental stress, or as an adaptive response to environmental stress. Normal physical growth is influenced by both genetic and environmental factors. Examining familial data from a well-nourished U.S. population, we estimate the influence of genetic factors on growth in stature over the course of childhood. Serial stature data (i.e., birth through adulthood) from participants in the Fels Longitudinal Study were used to derive relevant stature growth parameters. Maximum likelihood-based variance component methods were then used to determine the heritability of each parameter and to examine the relationships among growth parameters by estimating genetic and environmental correlations between the traits. Heritability estimates for the growth parameters are generally high and statistically significant ranging in magnitude from 54-92%. These results show that in a well-nourished population, physical growth in stature is a highly canalized process under strong genetic control. As such, human growth measures are expected to be highly efficient in their response to selective pressure.

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Bone stiffness variation in the mandibular symphysis of colobine monkeys.

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The sympatric cercopithecids *Colobus polykomos* and *Procolobus badius* process qualitatively different diets in the wild, with the former taxon seasonally feeding on hard seeds. Predicted differences in mandibular size and geometry, however, fail to reflect the varying functional demands that this dietary difference putatively entails.

The implicit assumption of biomechanically-informed comparisons of size and shape is that the material properties of bone are invariant and similar among specimens under examination. We tested the validity of this assumption through microindentation of cortical bone from the mandibular symphysis in 6 adult specimens (2 male and 1 female each) of *C. polykomos* and *P. badius*. Using a Vickers indenter with a 100 g mass and 10 s dwell time, we collected 271 hardness samples at intervals of 0.5-2 mm on labial and lingual cortical bone polished from transverse sections through superior and inferior transverse tori. These hardness values were converted to elastic modulus through linear regression.

The mandibular bone of *C. polykomos* is significantly less stiff than that of *P. badius*; in both taxa female stiffness val-

ues are significantly higher than those of males. Moreover, the bone from the highly-strained lingual cortex is more compliant than that of the labial cortex. No systematic difference in modulus is observed between superior and inferior sections nor among indentations sampled along a mesiodistal gradient. These results suggest that bone's response to magnified stress environments does not necessarily entail material stiffening. Instead, greater compliance enhances toughness at the expense of strength, providing effective resistance to fatigue failure.

Athletes: How different are they from the rest of us?

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Current methods for estimating body mass do not account for both lean and adipose tissue. It is reasonable to assume that prehistoric people were leaner than modern Americans. In fact, some researchers have likened prehistoric peoples' body composition to that of Olympic athletes. However, elite athletes may not provide a good reference sample for modern individuals in forensic contexts. In a previous study, we used stepwise regression formulae to estimate body mass for female collegiate athletes and non-athletes. Utilizing only anthropometric measurements that largely reflect underlying skeletal dimension, the single most useful measurement was bicondylar breadth. This study focuses on determining the usefulness of athletes as a reference population for estimating the body mass of non-athletes.

The mean weights, heights, and BMIs of white female collegiate athletes and non-athletes were statistically analyzed. There is no significant difference in BMI ($p = 0.94$), yet both the mean weight and height of athletes differ significantly from non-athletes ($p < 0.0001$). When the athletes are subdivided by sport, the mean weights for divers, tennis, and track and field athletes as well as the mean height for divers are not significantly different from non-athletes. When the body mass of non-athletes is predicted from the athletes' best multiple regression equation using skeletally-based measurements, the non-athletes' body mass is consistently underestimated and the R^2 value falls from 0.764 to 0.532. Athletes are not an appropriate reference population to estimate the body mass of contemporary populations.

Experimental analysis of human footprint generation.

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Fossilised footprints contain information about the dynamics of gait, but their interpretation is difficult, as they are the combined result of foot anatomy, gait dynamics and substrate properties. We explore how footprints are generated using modern humans.

Sixteen healthy subjects walked on a solid surface and in a layer of fine-grained sand. In each condition, 3D-kinematics of the leg and foot were recorded for 15 trials at preferred speed, using an infrared camera system (Vicon). Additionally, plantar pressures (Footscan) and ground-reaction forces (Kistler) were recorded. After each trial in sand, the depth of the imprint was measured under specific sites using calipers.

Subjects walked slower in sand than on solid ground, with more flexion of the knee during the swing phase and less extension prior to heel strike. Maximal pressure was the most influential factor for footprint depth under the heel. Footprint depth at the midfoot is best predicted by foot morphology (flat, "normal" or high-arched). At the 2nd metatarsal head, footprint depth is mainly determined by peak pressure and maximal impulse. The depth of the hallux imprint correlated best with body mass and peak pressure.

We conclude that footprint morphology cannot be related to a single variable, but that different zones of the footprint reflect different aspects of the kinesiology of walking. Therefore, an integrated approach, combining detailed kinematics, plantar pressure recordings, kinetics, and morphological data, is needed.

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Locomotion and skeletal differentiation within the *Pitheciini*.

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In previous studies comparing positional behavior and anatomy of *Pithecia* and *Chiropotes*, the focus has been on the leaping and clinging of *Pithecia* and the quadrupedalism of *Chiropotes*, together with their associated anatomical differences. While little detail is known of the positional behavior of *P. monachus*, preliminary and anecdotal evidence indicates that quadrupedal locomotion and use of horizontal supports figure more prominently than in *P. pithecia*. Here we compare the postcranial skeleton of *P. monachus* with that of *P. pithecia* and *Chiropotes satanas*. More than 150 size-corrected measurements from the limbs, hand, and foot were statistically compared among the three species.

The three pitheciins are largely undifferentiated in slightly more than half of the metric traits examined. Interestingly, *Chiropotes* and *P. monachus* share a significant number of traits exclusive of *P. pithecia*, including an elongated infraspinous fossa of the scapula and a deep ulnar midshaft. These traits may be consistent with their quadrupedal habits, although the significance of other shared traits is less evident. *P. pithecia* is distinguished from the other two pitheciins by a suite of traits in the elbow region, a number of features in the knee, and elongation of several limb, hand, and pedal elements. Many of these features in *P. pithecia* are consistent with its leaping and vertical clinging habits and accord with previous studies documenting other postcranial leaping adaptations. The significance of these results for the evolution of locomotion in the pitheciin clade will be discussed.

Reconstruction of stature from head circumference.

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Estimation of stature from the skeleton is often based on partial remains. Sometimes only skulls are available in forensic cases or archaeological collections. In this study regression of stature on head circumference through glabella and opisthocranion and the ratios of stature to head circumference were calculated in samples from three populations: South African Blacks (m=30, f=30), South African Whites (m=30, f=30) and Australians of predominantly European extraction (m=60, f=1227). Ratios seem to be simpler and more reliable in predicting stature than regressions. The average ratios were: black males 3.08 (sd=0.16), white males 3.21 (sd=0.12), black females 2.98 (sd=0.11), white females 3.07 (sd=0.09), Australian females 2.95 (sd=0.12) and Australian males 3.05 (sd=0.13). Differences between groups and sexes were significant ($p \leq 0.05$). Average errors of stature predicted from ratios range from 39 mm to 66 mm. These errors appear to be within a reasonable range for stature prediction in forensic analysis. Thus, when no long bones are available, it may be useful to predict stature from the skull

by multiplying the head circumference by a factor close to 3.0. Head circumference as measured in this study includes thickness of soft tissues. This thickness on average is about 6 mm in Australians. Correcting for this produces a ratio of skull circumference to head circumference equal to 0.935. Such ratio should be used when reconstructing stature from dry skull circumference.

Long bone curvature in Neanderthals and modern humans: A new method for measuring long bone curvature using 3D landmarks and semi-landmarks.

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Long bone curvature has normally been studied by using the radius of curvature or the subtense taken from the cord to point of maximum curvature. These techniques assume that the curve is either an arc on the perimeter of a circle or regular in form. They therefore do not provide information about the pattern of the curvature.

We describe a new technique developed in the context of research into bone curvature in Neanderthals and other Late Pleistocene and recent hominins. Our technique uses 3D landmark and semi-landmark analysis, the latter of which has only previously been used on cranial features. The combination makes it possible to include both point and outline information in a single analysis and permits study of the anterior, posterior, medial and lateral curves separately or as part of the total bone morphology. A superimposition step (generalized Procrustes analysis) eliminates the effects of scale.

Intra-observer error was assessed using Procrustes distances calculated between individuals as well as between repeats of each individual. The distances between repeats are significantly smaller than between individuals, demonstrating that landmark data collection is reliable although care must be taken when defining the number of semi-landmarks used. Larger numbers of semi-landmarks result in greater error between repeats, possibly due to the exaggeration of measurement error.

Contrary to some earlier research using other techniques, we identify significant differences between Neanderthals and anatomically modern humans. These results indicate that 3D landmark and semi-landmark analysis improves upon previous methods in the amount of information provided.

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Bonobos really do eat more THV: Using incisal curvature to interpret dietary behaviour for *Pan paniscus*

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Although *Pan troglodytes* (chimpanzees) and *Pan paniscus* (bonobos) are predominantly frugivorous with a preference for soft-textured food items, it has often been inferred that the latter consumes greater quantities of terrestrial herbaceous vegetation (THV). This dietary distinction is a fundamental component of hypotheses that seek to explain significant socio-ecological differences between *Pan* species (i.e. larger bonobo group sizes, higher degree of socialization in bonobo females) as a consequence of decreased intra-species competition in bonobos resulting from the increased consumption of continuously available THV. However, higher THV consumption in bonobos is only weakly supported by limited field data based on indirect proxies for dietary behaviour (i.e. time spent feeding, fecal analysis). Likewise, corresponding analyses of *Pan* molar morphology demonstrate that both species overlap significantly, although bonobos have larger shearing crests on their upper molars consistent with increased levels of THV consumption. This study addresses the potential for a detailed morphometric analysis of incisal curvature to provide higher resolution dietary information for bonobos.

I used High Resolution Polynomial Curve Fitting (HR-PCF) to quantify and evaluate the labial and occlusal curvatures of incisor crowns representing *P. paniscus* (n=38), *P. troglodytes* (n=37), *Gorilla gorilla gorilla* (n=34), *G. g. graueri* (n=46) and *G. g. beringei* (n=19). Analysis of the resulting dataset confirms that diet more strongly correlated to incisal curvature than phylogeny, and while bonobos are most similar to chimpanzees, they are morphologically intermediate between that taxon and seasonally frugivorous gorillas (i.e *G. g. gorilla*, *G. g. graueri*), which suggests increased levels of THV consumption.

Extracting three-dimensional information from the hominid mandibular dentition.

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It is becoming increasingly common to extract morphometric information from three-dimensional models. For researchers interested in dental morphology, tools for extracting information from three-dimensional models have been adapted from Geographic Information Systems (GIS). GIS based measurements have been successfully used to quantify aspects of occlusal morphology, but may not be the most appropriate tools for studying nonocclusal dental morphology. This study uses a new tool for examining the configuration of the buccal surface of the mandibular premolars and molars in fossil hominids. The shape of the buccal surface is assessed using a quadric surface fitting program, which is now being applied to studies of other anatomical regions. A quadric surface is fit to three-dimensional models of dentition that are created from laser scanning. The parameters of the quadric surface are used to describe the curvature of the buccal surface of the tooth.

The premolars and molars of *Pan troglodytes* (n=10), *Otavipithecus namibiensis* (n=1), *Ouranopithecus macedoniensis* (n=3), *Australopithecus anamensis* (n=5), *A. afarensis* (n=10), *A. africanus* (n=10), and *Homo habilis* (n=10) are chosen for this study because of previously reported qualitative and quantitative differences in the configuration of the buccal surface of their teeth. Measurements derived from the quadric surface fitting technique are compared to traditional measurements of molar flare and the relative placement of cusps on the occlusal surface. Weak correlations between the parameters of the quadric surface and traditional measurements are observed. The traditional measurements rely on two-dimensional ratios to describe the morphology of the buccal portion of the tooth and result in the loss of three-dimensional information. This study demonstrates the usefulness of applying quadric surfaces to teeth but the technique is not limited to studies of dental morphology.

Debating human phylogeny since 1860: stasis or progress?

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Debates on human phylogeny since the inception of paleoanthropology around 1860 are often depicted as being largely devoted to recurrent issues about linear or multilinear hypotheses. It is assumed by this traditional historiography that key issues had already been defined in this early period, the following periods being essentially devoted to gather the relevant empirical material or build the proper theoretical context in order to favor one phylogenetic hypothesis or another.

This traditional view of the development of paleoanthropology is challenged. A thorough survey and analysis of the literature from 1860 to 2000 reveals clearly that the field went through three distinct historical and epistemological phases: 1860-1895, 1895-1935, 1935-2000.

Each phase faced distinct issues and challenges as to how to resolve phylogenetic questions. It is by resolving them that paleoanthropologists managed to push their field forward to a new phase. By so doing, they continually reduced the diversity of hypotheses judged scientifically defensible, a diversity which was impressive in early periods and not merely restricted to the linear-multilinear dichotomy. Although changes in theories of evolution somewhat impacted on the development of the field, it is clear that the main drive of progress throughout the periods was mainly empirical in nature. Today's debates on human phylogeny are nearly consensual when looked from a deep historical perspective.

Genetic influences on growth rate during infancy: Data from the Fels Longitudinal Study.

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Diminished childhood growth rate relative to the genetic potential to grow can be seen in an evolutionary framework as a function-sparing adaptation to adverse environments. However, the presence or absence of adaptation is difficult to ascertain when parental growth (which is often used to determine "genetic potential") has been affected by nutritional stress as well, or when the prevailing nutritional environment is rapidly changing. To gain insight into the genetic potential to grow under a "best case" scenario, we will use familial data from a well-nourished U.S. sample to examine the genetics of growth during infancy, when decrements have the most enduring and marked effects. Log-linear functions were used to fit curves to serial weight data from 0-3 years for 523 participants in the Fels Longitudinal Study, and predicted weights and weight velocities were calculated at each age. Multipoint variance components linkage analysis was conducted in a subset of individuals to identify chromosomal regions influencing early growth. Infant growth and growth velocity were under relatively strong genetic control, with heritabilities greater than 0.8 on average. However, a higher impact of environmental factors was evident in early infancy than later infancy; heritability of infant growth rate was 0.6 at birth and rose to over 0.9 at age 6 months—a reflection of growth as a target seeking function and recovery from maternal environmental effects on growth. Linkage analyses also suggested particular regions of chromosomes 3, 6, 10, 11, 12, and 16 that harbor genes influencing infant weight and infant weight velocity.

Relationship between neonatal brain and body mass and menstrual bleeding in primates.

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True menstrual bleeding is found in all catarrhine primates, some platyrrhine monkeys (*Cebus* and the atelines), some chiroptera, and elephant shrews. Although the developing brain has been implicated as a selective force in many aspects of uterine physiology, the relationship between neonatal brain mass and menstrual bleeding has never been tested. Neonatal brain masses from 43 primate species were compiled from the literature and from Yerkes and Oregon National Primate Research Centers. Menstrual patterns were categorized as absent or covert, slight, and overt. We analyzed the data using independent contrast statistics from COMPARE 4.6.

There is a strong relationship between the presence of menses in primates and the size of the neonatal brain/surface area of the adult uterus ($r=0.29$; $p=0.06$). We also found a statistically significant relationship between the neonatal litter mass/adult female body mass and whether menstruation is slight or overt ($r= 0.34$; $p= 0.02$). The percentage of brain growth *in utero*, neonatal brain size relative to gestation, length of the follicular phase, and neonatal brain size relative to adult female body size showed no relationship with menstrual bleeding.

It is unclear which of the above measurements best test the impact of neonatal brain growth on female reproductive physiology. These results are complicated by the scarcity of reliable data on neonatal brain masses in primates. Comparisons will also be made using available data on menstruating bats and elephant shrews.

Estradiol, strain, and periosteal bone growth.

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Recently we showed that estradiol (E_2) increases osteogenic responses to loading, a mechanism that may underlie variation in human skeletal robusticity. This hypothesis was supported in sheep (*Ovis aries*, N=32) exposed to either low or high E_2 levels and either sedentary or high activity levels. Periosteal growth in exercised animals was 25-75% greater in high-E_2 than in low-E_2 animals, but only 15-20% greater in sedentary high-E_2 vs. low-E_2 animals.

Although E_2 clearly stimulates bone growth, it is unknown whether this growth improves resistance to deformation. This study tests the hypothesis that E_2-induced periosteal growth coincides with areas of peak tensile strain at midstance. We calculated midshaft cross-sectional properties (polar moment of area, J_N; section moduli of tension and compression, Z_{Nt}, Z_{Nc}) in the tibia and metatarsal using the experimentally determined neutral axis (Lieberman et al., 2004) and compared them to areas of bone growth during the experiment.

Results indicate little variation in J_N, although it is greatest in high-E_2 animals. In the tibia, section moduli are similar in the low-E_2 and high-E_2 sedentary groups. However, Z_{Nt} and Z_{Nc} are 17-20% greater in high-E_2 vs. low-E_2 exercised animals, corresponding to periosteal deposition on the anterior and posterior surfaces of the bone. In the metatarsal, Z_{Nt} and Z_{Nc} are 13-24% greater in the high-E_2 exercised vs. the sedentary groups, corresponding to deposition on the posterior surface. These results support the hypothesis that E_2-induced periosteal growth improves bone's resistance to bending, which may have functional implications for human bone growth.

The genetic architecture of 2-D molar cusp areas in baboons: implications for hominid evolution.

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Tooth morphology plays a central role in reconstructing phylogenetic relationships among primates, as well as interpretations of diet and behavior. This is especially the case for extinct species that may be known only by their dental remains. Therefore, investigations of the genetic and non-genetic factors that contribute to the variation in tooth morphology are critical. The relative size of molar cusps has been an important character within hominid evolutionary studies. But past research has been limited to phenotypic variation, with no information about the possible pleiotropic affects that may influence morphological evolution. Here, we present the first quantitative genetic analysis of 2-D left mandibular molar cusp areas (protoconid, metaconid, entoconid, and hypoconid). These phenotypes were collected from captive pedigreed *Papio hamadryas* individuals from the Southwest Foundation for Biomedical Research and Southwest National Primate Research Center ($n>600$). Our analyses of all 12 cusp area phenotypes return significant total heritabilities that average 0.28 ($h2r = 0.38$), and indicate that sexual dimorphism accounts for approximately 24% of the total phenotypic variance. Through bivariate analyses, we find that the protoconid and entoconid have shared genetic effects estimated to be 1 or insignificantly different from 1. In

contrast, the minor variation in size of the metaconid relative to the hypoconid is estimated to be genetically independent for all molars. The evolutionary implications of this genetic architecture will be discussed.

Taxonomic variation in facial mobility among anthropoid primates.

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Anthropoids use facial displays to mediate social relationships within groups. Display complexity is a function of the mobility of the superficial facial muscles. Qualitative observations suggest that considerable variation in facial mobility exists among anthropoids. However, this issue has never been examined quantitatively. The purpose of this paper is to analyze patterns of variation in facial mobility between anthropoid superfamilies.

Video recordings were collected from zoo animals representing 12 species (4 ceboids, 5 cercopithecoids, and 3 hominoids). Facial action repertoire size, or the number of discrete muscle actions, was estimated for each species using standardized criteria defined by the Facial Action Coding System (FACS). Box plots and cluster analysis were used to visualize differences in the degree and pattern of facial mobility between superfamilies. Body mass is highly correlated with facial action repertoire size ($r = 0.95$). Thus, analysis of covariance (ANCOVA) was used to test for significant differences in mean repertoire size between groups.

On average, hominoids have the most mobile faces, while ceboids exhibit the least mobility and cercopithecoids are intermediate. Exceptions include *Hylobates concolor*, which groups with cercopithecoids, and *Cercopithecus neglectus*, which groups with ceboids. However, ANCOVA reveals no significant differences in the degree of facial mobility between superfamilies, controlling for body mass. The results of this study suggest that taxonomic variation in facial mobility among anthropoids is primarily a function of body size.

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On using zinc in teeth to interpret maternal and infant diet and health: insights from analyses of a contemporary Mexican sample.

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The assessment and interpretation of zinc (Zn) concentrations derived from chemical analyses of biological hard tissues has been troubled by the complexities inherent in working with an essential trace element implicated in several important biological processes. Because Zn is subject to some homeostatic control by the body and does not undergo a clear trophic level separation several researchers have suggested its utility for paleodietary reconstruction is severely limited. However, with an understanding of the nature of Zn physiology, nutrient interactions and local factors affecting bioavailability it may yet be possible to utilize measures of hard tissue Zn concentrations in evaluating diet and health.

Pre-and-postnatal enamel Zn levels were determined via LA-ICP-MS for 80 teeth collected from 46 infants participating in a large longitudinal study (NCRSP) in Mexico during the mid-1980s. Relationships between enamel Zn levels and ~200 variables documenting maternal diet and infant growth, morbidity and cognitive development were explored. Some significant findings suggest that an individual's prenatal enamel Zn content reflects certain aspects of their mother's pregnancy diet. Further, prenatal enamel Zn appears to be predictive of the cognitive development of these Mexican infants. These results suggest that, despite the fact that Zn is an essential element, its variation among individuals' dental enamel may be understood in terms of maternal diet during crown formation, and be indicative of future functional outcomes.

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Mitochondrial DNA analysis of Pleistocene bison.

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Ancient DNA sequences, specifically the control region of mtDNA, have proven to be an important tool in evaluating evolutionary trends and population dynamics of extinct species. Bone samples (n=33) of *Bison priscus* were obtained from the Kolyma Region of Siberia, Russia. Throughout the Pleistocene, *Bison priscus* ranged from modern-day Europe to Central America eventually going extinct around the Pleistocene-Holocene transition. Furthermore, two modern species, *Bison bison* (North American bison) and *Bison bonasus* (Eurasian bison), are descended from *Bison priscus*. Their wide distribution, sustained presence throughout the Pleistocene, and presence of modern descendents makes bison an excellent model to investigate faunal migration and phylogenetic relationships.

DNA was extracted from approximately 300 mg of bone from each sample using a silica/guanidine thiocyanate method, and a 766 bp portion of the mitochondrial control region was amplified and sequenced. Samples that have been sequenced to date have radiocarbon dates between 20,000-40,000 years old. The ancient mtDNA sequences from *Bison priscus* are compared to sequences from the two modern species of bison. From the comparisons, insights are provided on migrational patterns of bison between North America and Eurasia via the Beringian sub-continent. Genetic distance measurements will be presented providing information on phylogenetic relationships. These data will be presented along with techniques in amplifying ancient DNA.

Upper- and lower-limb skeletal muscle site variability in modern humans.

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Skeletal muscle site morphology has often been used to interpret activity variability among human populations. Although greater muscular activity and older age appear to result in more marked insertions, the specific roles of intensity vs. frequency of muscle contractions are not well understood. Previous researchers have hypothesized that robusticity and, possibly, stress lesions are the result of habitual contractions while exostoses results from stronger, but less habitual contractions. This study compares muscle insertion morphology of the lower and upper limbs in a human archaeological sample (n=47). It is hypothesized here that the upper limb will be more variable than the lower limb in expression of robusticity, lesions, and exostoses because the lower limb is constantly used in locomotor activities that are mostly symmetrical while use of the upper limb is more characteristically asymmetrical. Muscle insertion sites of the right and left upper and lower limb were scored for robusticity, lesions, and exostoses on a scale from 0 to 3 following Hawkey (1988). For each individual, average differences between left and right scores are calculated for upper and lower limbs and compared statistically. Results show that the upper limb is not more asymmetric than the lower limb in robusticity or lesions. Interestingly, the lower limb is more asymmetric than the upper limb in exostoses. In addition, the lower limb has relatively more exostoses than the upper limb. These results suggest that exostosis may develop from very powerful contractions that are more frequent in the lower limb than in the upper limb.

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Morphological and hormonal correlates of 'masculinization' in ringtailed lemurs (*Lemur catta*).

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Ringtailed lemurs represent a valuable model for examining current theories of sexual differentiation, the role of androgens in mediating aggression, and the evolution of primate social systems, as females display a set of masculine characteristics, including a pendulous clitoris, size monomorphism with males, and social dominance over males. To explore whether androgens may 'organize' or 'activate' the expression of these traits, this study examined morphology and serum endocrine profiles in captive lemurs, at the Duke University Primate Center, across portions of the reproductive life span. Experiment 1 measured the external genitalia of intact adults (9 females, 9 males) to characterize the extent of female morphological 'masculinization.' Females displayed a shorter anogenital distance and a larger urethral meatus, but total clitoral width and length were comparable to those of the extruded male glans. Experiment 2 examined steroidal fluctuations in adult lemurs (10 females, 12 males) over 4 annual cycles, and assessed hormonal correlates of prenatal development in 16 pregnancies. Adults of both sexes showed a significant breeding season peak in steroid production. Whereas male testosterone (T) concentrations exceeded those of females, both sexes showed comparable androstenedione (A4) concentrations. Pregnancies that produced singleton males, twin males, or mixed sex twins showed higher T, A4, and estradiol (E2) concentrations, especially late in gestation, than did pregnancies that produced singleton or twin females, but steroid concentrations in female-producing pregnancies consistently exceeded preconception and postpartum values. These data are consistent with the hypothesis that female lemurs may be partially masculinized through exposure to maternal androgens.

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Mitochondrial DNA Variation in Northern Altaian Ethnic Groups.

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Archaeological and historical evidence show that the present-day Altai Republic has experienced a series of invasions/migrations over the past several millennia. These population movements have led to a complex biological and cultural history for the indigenous populations of this region. Indigenous Altaians are generally divided into northern and southern groups based on well-established linguistic, physical and cultural differences. Classical genetic markers studies have also revealed differences between these two groups, with varying amounts of influence from Central Asia, Western Eurasia and East Asia being detected. To further elucidate the genetic diversity of Northern Altaians, we analyzed SNP variation in mtDNAs from Chelkan, Tubalar and Kumandin individuals (N=240) living in eight villages in the northern Altai Republic. The majority of the studied mtDNAs lineages were characteristic of other Turkic-speaking groups of native Siberians, with some minor subbranches appearing to be specific to these populations. Comparisons between the Northern Altaian ethnic groups revealed a substantial difference in the genetic substructure of the villages. While most haplogroups were found in all three ethnic groups, Chelkans possessed the majority of haplogroup F, N9a and N* types, showing close relation to Khakass population. On the contrary, Kumandins demonstrated a paucity of Western Eurasian lineages, and instead had an abundance of East Eurasian haplogroup C types. Interestingly, in about half of the villages, these ethnic groups did not share the same haplogroups. This information provides us with a better understanding of the population histories of Altaian populations and how they relate to their Siberian neighbors.

Left and right side symbolism in trophy taking among the Postclassic Maya.

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Bioarchaeologists have become increasingly interested in identifying evidence of vanquished enemies and trophy taking in the archaeological record. In many cases it is only possible to identify, through cutmark analysis and examination of underrepresented elements, if such violation occurred. In some cultural contexts, such as the Maya area, accompanying lines of evidence allow for insight as to why certain body parts were taken as trophies. Recent analysis of a Postclassic (AD 950-1524) Maya mass grave from the northern Guatemala found a discrepancy between the representation of left and right humeri, radii, and ulnae, as well as molars. Specifically there was a statistically significant underrepresentation of the left radii, ulnae and molars. Additionally one human molar and one animal canine had holes drilled in their roots, suggesting that trophy taking did occur. Palka (2002) recently demonstrated that victors in Maya murals are right handed, while the vanquished are left handed. This paper presents evidence demonstrating that the right arm and forearm bones and molars from the mass grave were intentionally omitted, reflecting an attempt to violate the deceased in part by emphasizing the left side of the body. Although such side discrepancy has been identified in animal caches in the Maya area, this marks the first time such side discrepancy has been identified among human remains.

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Hindlimb adaptations in *Ourayia* and *Chipetaia*, relatively large-bodied omomyine primates from the Middle Eocene of Utah.

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North American omomyids represent a tremendous Eocene radiation of primates exhibiting a wide range of body sizes and dietary patterns. Despite this adaptive diversity, relatively little is known of the postcranial specializations of the group. Here we describe hindlimb and foot bones of *Ourayia uintensis* and *Chipetaia lamporea* that were recovered from the Uinta B member (early Uintan Land Mammal Age), Uinta Formation, Utah. These specimens provide insight into the evolution of postcranial adaptations across different body sizes and dietary guilds within the Eocene primate radiation. Body mass estimates based on talar measurements indicate that *Ourayia* and *Chipetaia* weighed about 1500-2000 g and 500-700 g, respectively. Skeletal elements recovered for *Ourayia* include the talus, navicular, entocuneiform, first metatarsal, and proximal tibia; bones of *Chipetaia* include the talus, navicular, entocuneiform, and proximal femur. Both genera had opposable grasping big toes, as indicated by the saddle-shaped joint between the entocuneiform and first metatarsal. Both taxa were arboreal leapers, as indicated by a consistent assemblage of characters in all the represented bones, most notably the somewhat elongated naviculars, the high and distinct trochlear crests of the talus, the posteriorly oriented tibial plateau (*Ourayia*), and the cylindrical head of the femur (*Chipetaia*). The closest resemblances to *Ourayia* and *Chipetaia* are found among the Bridger omomyines, *Omomys* and *Hemiacodon*. The results of our comparisons suggest that the later, larger, more herbivorous omomyines from Utah retained skeletal structure characteristic of earlier, smaller North American omomyids.

The sex of the Lake Mungo 3 skeleton.

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The Lake Mungo 3 skeleton has been the subject of controversy since its discovery in 1974. Thorne (1977, 2002) has long argued the existence of two distinct founding populations of early Australians, a "robust" morph and a "gracile" morph, and Lake Mungo 3 has been categorized as a "gracile" male in this dichotomy. Brown (1987, 2000) has criticized these ideas, questioning the rationale behind the partitioning of the Pleistocene Australian skeletal sample into different populations. In addition, Brown (2000) has alleged that the sex of Lake Mungo 3 cannot be determined from the available evidence, since the skeleton lacks the most diagnostic areas of the skull and pelvis.

In an effort to reexamine these questions, our team collected an exhaustive battery of cranial and postcranial measurements from the Lake Mungo 3 skeleton. These measurements are compared to a number of Australian samples of known sex, both from the Pleistocene as well as the Holocene, in an effort to diagnose the sex of Lake Mungo 3. In all, approximately 12 cranial and 55 postcranial measurements can be used for these comparisons.

The results of our work do support the assignment of male sex to Lake Mungo 3. Many of the postcranial measurements sampled fall at the extreme high end of the male sample, sometimes beyond the observed male range, and likewise fall well outside the female range. However, these results also lead us to question the attribution of Lake Mungo 3 to a "gracile" category amongst early Australians.

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An evaluation of variation in the biology and lifeways of two pre-contact Point Hope, Alaskan Inupiat cultures as evidenced by their thoracic morphology.

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The subsistence strategies and related activity patterns of the pre-contact Point Hope Inupiats are not well-documented archaeologically. Analysis of the artifacts associated with the two pre-contact cultural groups (Ipiutak and Tigara), has led to the hypothesis that their lifeways were dissimilar despite sequential occupation of the same location in coastal Alaska. The absence of whaling implements in the Ipiutak sample has led some to speculate that their subsistence was primarily based on sealing and walrusing, with seasonal procurement of caribou; whereas evidence from the Tigara cultural period supports the view that these later people principally subsisted upon whale resources. In the present study, I test the hypothesis that lower rib-cage sulcal patterning in the Point Hope Inupiats is associated with their subsistence strategy and related activity patterns, and may be used to differentiate the Ipiutak and Tigara using a muscle stress marker (MSM) analytic approach. To this end, discrete coding of the 11th and 12th ribs for *iliocostalis* and *quadratus lumborum* mm. muscle scarring was compared among a mixed-sex sample (n=250) of Point Hope Inupiats. Additionally, respiratory area, curvature, and sexual dimorphism were examined for a small subset of the Point Hope sample (Tigara; M=10, F=7). My major results support a relationship between variation in activity pattern and the patterning of lower rib robusticity and muscle insertion rugosity. These results, and further considerations, suggest that additional study of Point Hope activity patterns from a MSM perspective, including handedness in relation to lower-rib patterning, is required.

Linnaean binomials and the Christian trinity: Faith-based barriers to scientific understanding.

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Both concepts -- binomials and the trinity -- logically require a suspension of disbelief. In the case of the trinity, one has to be able to believe that three entities simultaneously also are a single entity; while in the case of Linnaean binomials, one must believe the converse, that single lineages that were continuous across thousands of generations can and should be represented (for "convenience" but really out of tradition) as being segmented into a chain or tree of discontinuous ancestor-descendant entities (or else, necessarily, parents of some conventionally-recognized taxon such as *Homo erectus* gave birth to a *Homo sapiens* child, for example). The connection to attempted insertions of "intelligent design" into biology curricula is that investigators still using the Linnaean system as an accepted part of "science" may be conditioning minds to accept logical impossibilities in other regards. (It is widely acknowledged that Linnaeus. was a creationist, but that embarrassing historical fact conveniently is just as widely ignored.) By extension, a biological curriculum that emphasizes mechanism and process rather than memorization of static taxonomic lists (*Australopithecus afarensis, A. africanus, A. robustus, ... ad infinitem*) is likely to be more effective in communicating the dynamics of living science, and distinguishing it from static creationism in its many guises. Biological scientists, including human biologists who study populations of our ancestors past and present, are not responsible primarily for the anti-intellectual assaults of "intelligent design," but they could and should play more thoughtful roles in providing contemporary rather than antiquated conceptual foundations.

A test of dental morphological traits used in forensic identification of ancestry.

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Very few, if any, human variants are truly population specific, with 100% frequency in one group and 0% in others. However, for traits to be of use in forensic identification they must be as population specific as possible. Several dental morphological traits have been identified in the forensic literature as useful in determining an unknown individual's ancestry. If these traits are of value, they will occur in their associated group in proportions statistically different from all other groups. Furthermore, the ancestral groups not associated with the trait should show no significant frequency differences among them.

To test this, dental morphological data was compared among samples of African Americans, European Americans, Hispanic Americans, and Native Americans (N=1625). Chi square tests were conducted on dichotomized frequencies of ten trait observations, including incisor shoveling, Carabelli's trait, canine mesial ridge, and cusp seven. Presence of these traits has been associated with particular ancestral groups in forensic anthropological studies.

Results were mixed. For example, shovel shape frequency is statistically different in Native Americans. However, significant differences are also seen among the other groups. Only canine mesial ridge was consistently different in African Americans and not different among the other three groups. Unfortunately, this trait is not common in any group (2%-21%), so lack of the trait is not indicative of ancestry. Overall, these commonly used traits may not be of much actual value in ancestry determination. Combining these traits with others not common in the forensic literature may be more useful.

Dietary habits of the Ipiutak and Tigara populations from Point Hope: an occlusal molar microwear analysis.

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Archaeological excavations at Point Hope, Alaska uncovered skeletal remains of two populations: the Ipiutak (550-900 A.D.) and Tigara (1400-1900 A.D.). Archaeological evidence indicates that, although both groups relied on animal (largely marine) resources for their subsistence, the Ipiutak were mainly caribou hunters, whereas the Tigara were primarily whale hunters. To date, no study has attempted to ascertain whether the inferred dietary differences of these two groups could be substantiated using a more direct technique, e.g. microwear or stable isotope analysis. In this study, the occlusal molar microwear fabrics of the Ipiutak and Tigara were analyzed. Comparative data for two other modern human groups, the Aleut and Arikara, were also examined. Significant differences in microwear signatures were detected among the groups considered. The microwear pattern of the Arikara, who had a mixed diet, differed from that of the mainly meat-eating Aleut and Point Hope peoples in that the Arikara has significantly fewer features, lower pitting incidence and narrower scratches. Differences in microwear signatures between the Aleut and the two Point Hope populations were also detected. Compared to the two Point Hope populations, the Aleut has significantly fewer features and wider scratches. The Aleut microwear signature further differs from that of the Tigara in having significantly lower pitting incidence. The results of this study show that the Tigara has significantly more microwear features, more pits and narrower scratches compared to the Ipiutak. These results are concordant with interpretations that the two Point Hope populations had significantly different dietary habits.

Microtomographic investigations of enamel thickness patterning and mandibular morphology in primates.

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Functional adaptations of the dentognathic system in primates have been the focus of a wealth of research, including studies on the patterning of molar enamel thickness and the shape of the mandibular corpus. Although mandibular corpus architecture and enamel thickness are both thought to be related to food hardness and masticatory stress, these aspects of morphology have largely been studied independently. Thus, a body of literature on the cortical thickness of the mandible as recorded via medical CT imaging exists separately from that describing enamel thickness patterning based on physical cross-sections, even though the masticatory apparatus functions as a single integrated system. Recent advances in the resolution of non-destructive imaging systems (e.g. microtomography) make it possible to record accurate, high-resolution images of mandibular cross-sections, producing measurable cross-sections of both the tooth crown and the mandibular corpus. The research presented here demonstrates this imaging ability in two primate taxa similar in molar enamel thickness and diet, but strikingly divergent in mandibular morphologies (*Hylobates muelleri* and *Ateles geoffroyi*). Nine common enamel thickness and seven mandibular cross-sectional measurements were recorded at standardized locations, and biomechanical properties of the mandible were estimated. Results indicate that the patterning and distribution of enamel thickness does not necessarily follow mandibular cross-section morphology. Although *A. geoffroyi* and *H. muelleri* represent similar ecotypes, occupying analogous niche space, differences in their dento-gnathic systems may be attributable to phylogeny. A larger sample encompassing greater dietary and phylogenetic breadth may provide greater resolution on the relationship between enamel thickness and mandibular morphology.

Pathology, constraint, and adaptation: how can we tell them apart?

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The study of developmental effects on adult human biology, has a long history. The "developmental origins of adult disease hypothesis" has recently refocused the attention of epidemiologists on correlations between events and outcomes that span human life history. At the same time human biologists and evolutionary biologists are proposing interpretive frameworks that strive to incorporate the new epidemiological information into existing theories of human life history evolution. Empirically, however, it is difficult to distinguish developmental effects that may represent pathology, constraint, and adaptation.

This talk will consider examples of developmental effects that are generally understood to fall in one or another of these categories tohelp articulate criteria to guide discrimination. These criteria will then be applied to the question of developmental effects on adult female reproductive function. Data from Polish women will be presented to illustrate possible empirical discrimination of adaptation from pathology and constraint.

Patterns and variation in long-distance communication of simakobu monkeys (*Simias concolor*) on Siberut Island, Indonesia - a pilot study.

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Long-distance or loud calls are common among vertebrates, and have been described in many primate species. Because these calls are more commonly produced by males and are often contagious, they are hypothesized to function in between-group communication, interpreted as resource or mate defense. Since intra- and interindividual variation in calls may convey information about the caller, such as condition, age, location, or rank, an analysis of this variation can provide insight into the functions of long calls. Adult male simakobu (*Simias concolor*) produce loud calls in a variety of situations: spontaneous calls, contagious choruses, and in response to loud noise such as thunder. Thus far only diurnal calling patterns have been described for different populations. The current pilot study aims to test hypotheses about the function of loud calls and intergroup competition in simakobu. Data were collected from June–August 2005 on several unhabituated groups within the 4,000 ha primary forest reserve of the Siberut Conservation Project (SCP), northern Siberut, Indonesia. All vocalizations heard during the 271 hours spent in the forest were noted together with time, location and stimulus and several calls were recorded on tape (06:00-19:00 hours). Diurnal distribution and context of long-distance calls were analyzed, as well as the acoustic variation between callers and locations. Distinct differences especially in call duration and frequency suggest that in simakobu calls might advertise more than just location. Besides male quality, the main study will also consider exhaustion and with it costs of calling as possible variables.

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Social relationships in Madagascan lemurs.

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When considering the evolution of sociality in primates, researchers often focus on agonism as an organizing principle, and affiliation and cooperation as manifestations of competitive alliances and reconciliation. However, affiliation is exceedingly common in primate social interactions and may form the real basis of social bonds.

Here we present data on the frequency and context of social behavior in three species of wild lemur that exhibit low agonistic rates (*Varecia variegata, Propithecus edwardsi, Eulemur fulvus rufus*). Data from January to December 2002 was used to derive rates (acts per hour) for affiliative and agonistic behaviors for several contexts (feeding, moving, resting and traveling). We found that frequency of affiliative behavior was higher than agonism in all contexts for the study species. In feeding contexts, for example, affiliative behaviors were frequent (range: 1.26-2.39/hr); in contrast, rates of agonism were low (range: 0.01-0.06/hr). We also compared time spent in spatial proximity (<5 m) in different contexts (time spent in proximity/total time spent in a particular context), and study species spent a significant amount of time in proximity with group members regardless of context. Proximity percentages were highest during resting and moving, and lowest when the study species were traveling. Time spent in proximity during feeding was 22.0% for *Varecia*, 35.3% for *Propithecus*, and 65.0% for *Eulemur*. We suggest that data on the frequency and context of behavior is necessary to better understand the proximate mechanisms that govern interactions within social groups.

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The uses and limitations of DNA-based tests for identifying Native American ancestry.

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Consumer DNA tests has made available to the public research tools previously confined to academic arenas. Particularly popular in the U.S. are tests to investigate and establish Native American (American Indian) ancestry. While such tests have allowed a greater number of people to investigate biological ancestry through their DNA, researchers not trained specifically in Native American prehistory or Native American genetic variation now offer these tests. Limitations of tests presently available and, in some cases, limitations inherent in biology present significant scientific and ethical considerations that are here addressed. Particularly important are instances of DNA testing for tribal enrollment where attempts have been made to establish biological criteria on group affiliation. Presented here are examples of tests available and their application and illustrations from ancient DNA analysis where prehistoric remains have been compared to modern individuals.

Selective processes in human reproductive success: heritability of life-history traits.

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In recent years, an increasing number of analyses have studied selection on many life-history traits in human populations, particularly phenotypic selection, heritability and the possible associations between these traits. From an evolutionary point of view, these studies are essential to determinate the degree of action of natural selection on human life-history traits and therefore their role in the evolution of populations. But the results of theses studies are often contradictory, because the problem of estimating exactly the portion of phenotypic variance due to additive genetic variance (heritability in its narrow-sense), and separate it from the variance due to environmental and nonadditive genetic (dominance and epistatic) factors. A great part of these problems stem from the close relationship between the analyzed individuals, because common shared environments and cultural transmission may make us overestimate heritability values. A way of avoiding this problem is to use an analytical method that takes into account the similarity between individuals of various degrees of relatedness, as the "animal model", a restricted maximum-likelihood estimation.

The current study uses the "animal model" to obtain heritabilities of human life-history traits as fecundity, age at first and at last child, individual λ, mean interbirth interval, adult lifespan, offspring survival and lifetime reproductive success (individual fitness) in Hallstatt (Austria). We obtained pedigree data from church records corresponding to a long period before demographic transition and industrial changes (1602-1852). We also analyzed correlations between the different life-history traits, and we obtained differences between male and female results.

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Who's behind the mask? Records and reality of a "Trophy" skull.

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The Miami Museum of Science (Miami, FL) accessioned a human skull (ANT 10-13-197) with scant provenance more than 30 years ago. Documentation described the skull as a European victim of "head-hunters" from Papua New Guinea. The edentulous skull is decorated with a face-like painted masked and dried plant material covering most of skull, resembling hair. There are no other associated artifacts or bone. The Museum requested forensic analysis of the skull with the restriction that none of the covering material be disturbed or removed. Anthropometric and visual methods were used to assess osteometric dimensions and anatomical markers for sex and racial affinity. Eight variables were analyzed with FORDISC software. Characteristics of the mandible, nuchal crest, mastoid process and measurements suggest that the skull is female. Morphology and variations of bone structure, as well as anthropometric data, suggest racial affinity with Oceanic Island peoples, not Europeans. No evidence of trauma or manner of death was found. Historical records indicate that "trophy" skulls were taken by victors of violent conflicts. Usually these skulls are adult males and exhibit evidence of trauma associated with death and/or decapitation. Our analyses suggest that this skull was likely recovered from a secondary burial or by exhumation. It may have been decorated and offered for sale with false documentation designed to meet the expectations of tourists. The results of this study suggest that re-examination of museum collections may disclose significant differences between reality and documentation supplied by donors.

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Do SK 15 and SK 45 from Swartkrans, South Africa, belong to the same species?

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There has been much debate about the taxonomic affinities of the mandibles SK 15 and SK 45 from Swartkrans, South Africa. While some researches attribute both specimens to the same hominin species, others disagree, assigning them to separate species. This study attempts to elucidate this problem by determining whether the range of variability exhibited by these two fossils falls within that of a single extant hominoid species. Breadth and height of the mandibular corpus at the M_2 were used to generate the geometric mean and a breadth/height index, representing size and shape respectively. Buccolingual (BL) diameter of the M_2 was also measured. The two mandibles were compared to an extant sample of gorillas, chimpanzees and modern humans. Since only two mandibles were compared, the exact randomization method was employed to calculate the probability of finding equivalent differences between pairs of mandibles within each species of the

comparative sample. In mandibular shape, the pair SK 15/SK 45 shows greater variation than any of the extant species, while both mandibular size and BL diameter do not. These results suggest that the specimens SK 15 and SK 45 should be allocated to different species.

A preliminary assessment of human perceptions of tarsiers and macaques in the Philippines.

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Perceptions of nonhuman primates living in close association with humans are primarily shaped by, and dependent on, interactions and cultural ideology of the people with whom they interact. Understanding local perceptions is critical for primate conservation efforts, ecotourism, and primate research. While some views are negative, as with crop raiding or disease transmission, there are also positive aspects, in part, due to cultural perceptions. To better understand this positive-negative dichotomy of attitudes toward primates, this preliminary study was conducted in the Philippines, where human-nonhuman primate interactions are understudied.

Data were collected from May-June of 2005. Interviews were conducted in Bilar, Tagbilaran City, and Corella (N=60). In addition to demographic information, participants were asked about their views of the tarsier and macaque, including their role in crop raiding, hunting, and ecotourism.

Within the Visayan region, the province of Bohol is recognized for their biodiversity and tarsier conservation efforts. Macaques are often viewed negatively and it is likely that the local, positive impressions of the tarsier may be a result of their threatened status, their role in ecotourism, or because they do not negatively impact the lives of humans. Overall, Boholanos are aware of tarsier conservation efforts in Corella and supportive of them. However, from this study, more of the beliefs and stories are concerned with macaques. Conservation efforts may be strengthened by considering cultural beliefs about animals and being cognizant of cultural diversity. Additionally, considering human perceptions of nonhuman primates may increase the implementation of successful conservation efforts by local communities.

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Evolution of primate brains: A cell biological perspective.

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Cell biology provides an opportunity to make direct links between genetics, development, and morphology, which is essential to elucidating the patterns and processes of evolution. Here we present two methods for studying the cell biology of brain evolution: a candidate gene approach and morphological description.

Microcephaly genes are excellent candidates for analysis because they have been positively selected for within the primate lineage. In addition, the morphological malformations result from single mutations in these genes and the consequent loss of protein drastically affects brain size. We report on one such protein, ASPM (abnormal spindle-like microcephaly associated), and propose a model for its role in brain size evolution. ASPM is expressed in symmetrically dividing (proliferating) progenitor cells, down-regulated in asymmetrically dividing (differentiating) progenitor cells, and acute knock-down results in an increase in asymmetric division and, consequently, premature neurogenesis at the expense of the progenitor pool. Evolutionary changes in this protein likely affect its function during mitosis of progenitor cells, ultimately affecting the duration of progenitor proliferation.

In a second approach, we aim to describe the neuronal lineage of primates in comparison to rodents. Two distinct neuronal progenitors exist in the developing rodent brain. In primates, a third neuronal progenitor has evolved. It is this novel progenitor that generates the vast majority of neurons in the primate brain. Thus, its origin is of evolutionary interest. We use markers to describe the lineage relationship between these progenitors and to assess the relationship of their abundance to brain size.

Food resources and survival among the Cofan of Ecuador.

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Traditional "sustainable" economies based on shifting cultivation, hunting, fishing, and gathering are dependent on low human densities along with extensive territories. Today, governmental movements to develop tropical rainforests have lead to the depletion of natural resources, undermined traditional subsistence strategies, increased population densities, and disrupted social systems. These changing environmental and social conditions are modifying the nutritional patterns and health of native populations and affecting their ultimate survival.

Presented here are preliminary findings on food consumption patterns and food availability in two Cofan villages of Northeastern Ecuador, Dureno and Zabalo, who are encountering different degrees of environmental degradation. Dureno is more directly affected by non-indigenous activities such as oil mining, agribusiness, and external colonization whereas, Zabalo, located further down-river, is more buffered from some of these stressors. A segment of each village participated in household food frequency (64%-D, 89%-Z) and individual 24-hour recall (20% of each village) surveys along with physiological (anthropometrics, blood pressure, glucose, cholesterol, hemoglobin, fecal parasite loads, and dental exams), health and cultural surveys.

The Cofan currently face a situation where most of their traditional lands are being settled by non-indigenous peoples resulting in deforestation, resource depletion, and environmental pollution, which is directly impacting their overall health and nutrition. The issues of food resources, development and survival raised by this study illuminate the need for further research into biocultural mechanisms that may be essential in maintaining rainforest populations in periods of great environmental stress.

Timing of formation of localized hypoplasia of the primary canine in humans.

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A commonly observed enamel defect in deciduous teeth is a flat-bottomed pit on the mid-labial surface of primary canine crowns termed localized hypoplasia of the primary canine (LHPC). Although poorly understood, their etiology is claimed to be distinct from linear enamel hypoplasia. One model for their development, proposed by Skinner and co-workers, posits that individuals with retinol deficiency may develop abnormal fenestrations of cortical bone overlying the canine crypt, making those ameloblasts that are unprotected by any bony covering vulnerable to damage from mild physical trauma. This is said to result from exploratory "mouthing", an activity occuring in the first year of life. Timing of the formation of LHPC is key to this hypothesis.

This paper presents the results of a histological study of LHPC carried out on teeth from one European and several New World populations. We are the first to establish an accurate chronology of formation using odontochronology. Our results, showing that the initiation of the lesion occurs between 3 and 4 months, fall on the lower side of the range estimated by

Skinner et al. of 3.6 to 7.4 months. However, our histological reconstruction of the sequence of events during lesion formation differs from other published interpretations. For instance, it is evident that LHPC are classic "pit form" hypoplastic defects, with stress markers (Wilson bands, accentuated striae) associated with the floor of pits. These stress markers occur through the whole ameloblast sheet, not just in the area affected by the lesion. This indicates a systemic disruption and we discuss alternative hypotheses.

Foraging peoples and state players in the Brazilian Amazon: implications of contact, settlement and diet among the Guajá Indians of Maranhão State.

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The Guajá Indians of Maranhão State, Brazil, have recently come into contact with Brazilian national society within the last 35 years. Formerly hunter-gatherers, the Guajá have been settled onto four semi-nucleated communities in Brazil's Eastern Amazon region. Since contact, the Guajá have embraced a host of mixed subsistence strategies to maintain their livelihoods. Under the auspices of Brazil's Indian Service (FUNAI), the Guajá presently practice hunting, gathering, fishing and swidden agriculture. In this paper, I discuss the causes and consequences of contact with the Brazilian State, focusing primarily on the Guajá's utilization of natural resources and their diet. While Guajá men still devote most of their subsistence time to hunting activities, the primary source of their community's diet stems from their swiddens. Similarly, fishing has played a stepped up role in the Guajá diet as they have been settled closer to watercourses. During this transition in Guajá history it is interesting to note that men are absorbing a bigger impact than are women and children to maintain group survivability. While women and children enjoy more leisure time than men, they also enjoy a better nutritional status. This paper concludes by proposing some measures that can be taken to ameliorate food security among the Guajá as they face an uncertain future. While farming has provided more food security among the Guajá many adjustments need to be made in order to guarantee a more broad-spectrum diet. Similarly, land tenure issues need to be resolved in order to secure their resource base.

Midfacial and femoral variation in a 9th century Croatian population.

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Extant populations of North America can be accurately differentiated through metric and non-metric analyses of crania and postcrania. Unfortunately, these methods are infrequently applied to a broader sample of spatiotemporally dispersed populations. This analysis utilizes four such methods to test two hypotheses about individuals recovered from a 9th century AD cemetery at the Croatian site Velim Velištak: 1) Individuals from the Velim population will classify as Euroamerican; 2) The range of variation observed within the Velim population will not significantly differ from that of a Euroamerican sample.

Measurements taken on individuals from Velim Velištak (n=47) were compared to three American populations: Amerindians (n=47), African Americans (n=61), and Euroamericans (n=64). Discriminant function analysis of the lower midface (Willson, 2004) classified 64.7% of the individuals from Velim as Euroamerican. Indices of the upper midface (Gill, 1988; 1990) and femoral platymeria data (Gill and Rhine, 1990) classified 39.0% and 55.3% of the Velim sample as Euroamerican respectively. Nasal sill form frequencies (Willson, 2004) between the Velim and Euroamerican samples were not significantly different. The variation exhibited by Velim did exceed the Euroamerican variation in all cases; however these individuals appear to be outliers.

The results of this analysis refute both of our hypotheses. Possible explanations include: 1) the comparative sample is not representative of the total range of variation within individuals of European ancestry; 2) Velim may have a different population history than the Euroamerican sample; 3) sample size may be a factor, and 4) Velim may represent a coalescence of two populations.

The utility of skeletal nonmetric analyses: a case study from the Eastern Mediterranean.

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Skeletal nonmetric data can produce a great deal of information, particularly when used in conjunction with other corroborative data such as ancient DNA analyses and stable isotopic analyses of human skeletal remains. Despite the guidelines proposed by Buikstra and Ubelaker (1994), however, all too often bioarchaeologists fail to collect nonmetric data that can suggest, for example, individual sex (i.e. septal apertures of the humerus are more frequently found among females), behavioral-environmental practices (i.e. external auditory tori linked with diving in cold water), and especially genetic relationships. The research from this study was collected as part of a larger project focusing upon health in antiquity (Fox-Leonard 1997) and includes dental, cranial and postcranial nonmetric data from two Eastern Mediterranean sites dating to the Hellenistic-Roman periods; Paphos, Cyprus (n=275) and Corinth, Greece (n=94).

Although most nonmetric observations were comparable between the sites, such as Carabelli's trait/cusp of permanent maxillary 1st molar crowns and deciduous maxillary 2nd molar crowns (prevalence of 40.5% at Paphos and 42.3% at Corinth), one nonmetric trait, namely tibial squatting facets, was found in much greater frequency among individuals from Paphos when compared to Corinth. Additionally, it appears that females were habitually squatting at Paphos as well. Discussion will focus upon possible cultural or occupational practices that women were engaged in at Paphos during Hellenistic and Roman times.

Anthropology meets creationism: taking primatology to schoolkids.

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Why communities are willing to adopt faith-based "science" perhaps lies in the lack of interaction among all levels of education. Scientists and citizens in Georgia formed a grass-roots organization devoted to quality science education. This group has produced several results: 1) scientists and citizens organized an informed, cooperative response that ultimately led to a bolstering of state biology education standards and testing; 2) science education administrators and teachers have become more aware of collaborative opportunities among all levels of education; and 3) through an increased emphasis on scientist-led outreach, this group has provided unique hands-on lectures, internships, and lesson enhancements for students within the greater Atlanta area. By providing access to fossil casts, primatological work, and science literature, students and teachers become more skilled in relating fundamental biological principles to everyday life. This anthropological outreach has fostered greater communication among the region's science educators and administrators. It has also made students less wary of biology classes, and more likely to appreciate evolutionary aspects of human biology.

Chronic under-nutrition and obesity.

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Evaluation of the epidemiological and anthropological data reveals that the risk of obesity during adulthood is inversely related to relative length. It is postulated

that this association is related to the interaction of growth of body proportions and under-nutrition. Analysis of the anthropometric and socio-economic data of Mexican-Americans (that participated in the Hispanic Health and Nutrition Examination Survey from 1982-1984) shows that poverty income index is more associated with leg length index than with sitting height. Similarly, the shorter the relative leg length the higher the skinfold thickness. Studies in England also indicate that that adult differences in leg length is associated with significant differences in cardiovascular disease, insulin resistance and birth weight. These findings support the hypothesis that adverse environmental circumstances operating during childhood and adolescence influences growth in leg and increases variability in leg length. Hence, a relative *short* leg length indicate that the individual have grown under negative environment that led to a slow growth and short leg. Finally, evaluation of previously unpublished metabolic data of lowland and highland children from Bolivia indicate that fat oxidation is directly related to relative leg length. That is, the lower the fat oxidation the shorter is the leg length. These findings support the hypothesis that adverse effects of poor environmental conditions during childhood influences both growth of leg length and increases the risk of obesity during adulthood. This research has profound implications for understanding the increased prevalence of overweight and obesity among populations undergoing a nutritional transition.

Evolution of dental eruption sequences in living and fossil colobine primates.

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Colobines are distinctive among catarrhines in their early eruption of molars relative to anterior teeth. We address the phylogenetic hypothesis of dental eruption sequence in colobines by examining fossil colobines from Europe and Africa. The degree of relative early molar eruption varies among colobine genera. Asian colobines (Presbytina) show more variation than do the African genera (Colobina), with sequences ranging from extreme early molar eruption in *Presbytis* to late (macaque-like) molar eruption in *Nasalis* (Harvati 2000).

The polarity of early molar eruption is unclear. Schultz (1935) suggested that the colobine pattern represents the primitive catarrhine condition. More recently, dietary and life-history hypotheses have been proposed to explain the variability in primate dental eruption sequences. If the colobine eruption pattern is primitive, it implies that papionins and hominoids converge on similar eruption sequences. Alternatively, if the colobine condition is derived, factors such as diet and mortality patterns probably shaped colobine eruption patterns.

Two fossil colobine species preserve juvenile specimens at informative stages of tooth eruption: *Mesopithecus pentelici* (Europe) and *Kuseracolobus aramisi* (Africa). Specimens were scored following Harvati (2000) from both original specimens and casts. The Late Miocene *Mesopithecus pentelici* erupts the second molar early relative to the second incisor, a common pattern in extant colobines (except *Nasalis*). The Early Pliocene *Kuseracolobus aramisi* does not show such an early relative eruption of the second molar, being most similar to *Nasalis* and to non-colobine catarrhines and less similar to living African colobines. Support received from Max Planck Institute and University of Oregon.

Assessing genetic structure in Balinese macaques and its implications for disease transmission.

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Recently several zoonotic and anthropozoonotic diseases have emerged on the Asian landscape. Primates are implicated as both pathogen hosts and reservoirs. Simultaneously, human alteration of habitats has increased. However, few studies have examined the relationship between pathogens, changes in existing landscapes, and primate populations. We are interested in how human manipulation of landscapes impacts macaque social and genetic structure and how these changes might influence pathogen ecologies among primates on Bali, Indonesia. Using a multi-locus approach, we are investigating distinct populations of long-tailed macaques (*Macaca fascicularis*) across Bali. Our goal in this preliminary study is to dissect how anthropogenic ecosystem level changes are effecting macaque populations on a genetic level. We utilize PCR sequencing techniques of markers for the sex-determining region - Y chromosome (SRY) and the displacement loop (Dloop) region of the mitochondrial genome with DNA extracted from blood. Preliminary results from 43 individuals across six populations provide contrasting views for parental markers, reflecting macaque social structure. Maternal markers indicate populations are separated geographically along matrilines and have maintained stability for long time periods. In contrast, *Y*-specific markers show that males move frequently between different populations indicating that males may be an important component for pathogen movement across Balinese landscapes. More accurate estimates of gene flow will be made using autosomal markers that average the migration effects of males and females. Further, genetic patterns of variation of the macaque populations will be overlain on the patterns of infectious agents present in these same populations to determine how macaque population structure can influence the evolution of infectious agents.

Evidence that birth weight is on the causal pathway to infant mortality.

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It is a common theoretical view that (low) birth weight is a correlate of adverse birth outcomes and not part of the direct, causal pathway to infant mortality. The empirical literature, on the other hand, consistently shows a strong association between birth weight, and adverse birth outcomes. The development of covariate density defined mixtures of logistic regression, a non-linear structural equation like model, allows a formal test of this issue. The aim of this paper is to determine if maternal age and parity (first birth versus higher order births influence birth outcomes directly, indirectly through birth weight, or both. The data consist of 6 NYS singleton birth cohorts 1985-88, i.e. white, black and Hispanic white. The models were fitted using standard maximum likelihood procedures. The results indicate that in all cases, maternal age and parity significantly influence the components of the birth weight distribution, and birth weight specific infant mortality. However, there is little evidence that maternal age has significant direct affects on infant mortality. Only 3 of 12 independent tests were significant, and all three occurred in the white population among "normal" birth weight births where infant mortality is generally low, no significant direct maternal age effects were observed among low birth weight or "compromised" births. These results suggest that most maternal age and parity effects on infant mortality operate indirectly on infant mortality through birth weight and not directly on infant mortality, suggesting that birth weight is a part of the causal pathway to adverse birth outcomes.

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A geometric morphometric analysis of the distal tibia of *Homo habilis*.

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The locomotor affinities of early *Homo* remain controversial. Some researchers argue that postcranial remains from Olduvai Gorge and Koobi Fora assigned to *H. habilis* show all the hallmarks of modern striding bipeds. Others posit that *H. habilis* was more mosaic in its locomotor repertoire, sharing a number of more primitive features with the South African *A. africanus*. The OH 35 tibia is central to this debate, yet complex 3D analysis of its distal articular surface has yet to be conducted. This study adds to this debate by using modern geometric morphometric techniques on the distal tibiae of fossil hominins and a comparative extant sample.

Homologous landmarks were designed to accurately reflect the shape of the distal articular surface. Data were collected using a Microscribe digitiser and the landmarks were registered and analyzed using the software *morphologika*. The comparative extant sample consists of 107 humans, 27 gorillas, and 15 chimpanzees. The fossil hominin sample consists of AL 288-lar, OH 35, KNM-ER 1481, and KNM-KP29286A.

PCA of the registered data reveals very distinct separation between all extant species with no significant overlap between *Homo*, *Gorilla* and *Pan*. When the fossil sample was considered both AL 288-lar and KNM-KP29286A fall well within the human sample, while OH 35 and KNM-ER 1481 consistently fell outside of it. This analysis indicates that in terms of the talar articulation of the tibia, the temporally earlier australopithecines share more shape similarities with fully bipedal modern humans than later species of hominin included in the genus *Homo*.

Mixed signals: When what you see is not what you get: A study of how female vervet monkeys (*Chlorocebus aethiops*) interact with males with artificially colored scrota.

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Female mate choice for male traits, revealing condition or competitive ability, has been extensively considered in primates. The limited existing evidence suggests that female primates might base mating preferences on male color, but experimental data with live animals have not existed until now. The present investigation evaluated whether female vervet monkeys (*Chlorocebus aethiops*) attend to individual differences in the blue-aquamarine colored scrotum of male vervets. Thirty adult female vervets were introduced to unfamiliar adult males during 90-minute experiments at the Barbados Primate Research Center. Male color was either Pale (n=10), Bright (n=10), or Painted (10), to resemble Bright coloration. Contrary to expectations, female interactions toward Pale and Bright males did not differ substantially. Females did appear to favor interactions with naturally colored males in that female-initiated affiliative behavior lasted significantly longer with Bright males (t=2.275, df=11.176, p=.044) and was somewhat longer with Pale males over Painted males (t=2.138, df=9.625, p=.059). By contrast, females directed significantly more aggression toward Painted males relative to Bright males (t=-3.000, df=18, p=.008) and somewhat more aggression toward Painted males compared to Pale males (t=-2.058, df=14.737, p=.058). These preliminary results suggest that females do not preferentially interact with Bright males, as was initially predicted. Females did interact more affiliatively toward naturally colored males, and when faced with a mixed signal, whereby color expression did not match the perhaps expected behavior, females behaved antagonistically toward males. These results support the hypothesis that females attend to male color jointly with behavior and adjust their behavior accordingly.

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Identification and interpretation of multiple fractures and inflicted trauma on an Iron Age peat bog body from northern Germany

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In 1959, the headless torso of an adult male from the Iron Age was discovered and excavated from a peat bog in northern Germany. The body displayed evidence of fractures to the left humerus, right clavicle, right femur, left fibula, right tibia and right fibula. Deep stab wounds were observed on the thorax and the penis had been excised. Through physical examination, image analysis and three-dimensional reconstruction, a re-evaluation of the fractures and trauma was undertaken. Although all fractures had originally been interpreted as peri-mortem, the re-examination indicated that several fractures were, in fact, taphonomic. The stab wounds and penis excision were deliberate and clearly peri-mortem. It is not possible to determine the definitive sequence of events, but it is clear that the man had been subjected to violence that led to his death. Cause of death can be attributed to one of three events: decapitation, a stab wound that penetrated the heart or exsanguination from the excision of the penis; it is likely that all events occurred nearly simultaneously and contributed to death.

Auditory exostoses found in Meroitic Nubians at Semna South: implications for subsistence strategies and/or social practices.

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Much success has been found in studies that explore auditory exostoses and their development from prolonged cold-water exposure due to subsistence strategies (Frayer 1988; Kennedy 1986; Velasco-Vasquez et al. 2000) or social practices (Manzi et al. 1991). In this study, individuals from the site of Semna South, representing the Meroitic (N=266), X-Group (N=26) and Christian (N=11) time periods are examined for auditory exostoses. The subsistence strategy hypothesis is used to explain presence of the trait. Three individuals from the Meroitic time period (or 1%) are found to have exostoses that mostly occlude the ear canals, suggesting prolonged cold-water exposure. Studies of ancient Nubian sites have discovered fish remains (most notably Nile Perch), implying their use as a resource (Adams 1977). However, if the Meroites were diving for marine resources in the Nile, a higher percentage of individuals possessing the trait is expected. The other hypothesis of social practices is examined due to the ill fit of the subsistence strategy model. Individuals who frequented Roman baths with cold-water chambers have been observed to have the trait (Manzi et al. 1991). Baths lacking heating capabilities have been found at the capital of the Meroitic period, Meroë (Adams 1977). Ancient Nubian migration patterns show they may have moved back and forth between Upper and Lower Nubia (Adams 1977). If they followed the Nile, it is possible these three individuals may have migrated from Meroë to Semna South (both located on the Nile). This information yields potential insight into migration patterns of ancient Nubians.

Out of Siberia: archaeological evidence.

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The objective of this paper is to present an archaeological framework for the late Pleistocene peopling of northern Siberia and Beringia. Current evidence suggests that there were at least two (and perhaps

three) major pulses of human colonization during this time—the first about 30,000-22,000 ^{14}C years ago and the others during the late glacial, after about 12,000 ^{14}C years ago. The first colonization event is documented by at least eight archaeological sites (some of which are still problematic) located in north-central Siberia and Yakutia (Sakha Republic) between 56° and 71° North latitude; however, currently there is no evidence that these humans spread across the Bering Land Bridge into Alaska. Following the last glacial maximum (20,000-18,000 ^{14}C years ago), human populations re-colonized the north, this time spreading not just from interior Siberia but perhaps also from maritime eastern Asia. Although this process may have begun as early as 17,000 ^{14}C years ago in some areas of southern Siberia (e.g., the Baikal region), far northern Siberia and Beringia do not appear to have been re-colonized until about 12,000 ^{14}C years ago, during the Alleröd warming episode. In the last several years, research in central Alaska, Chukotka, and Kamchatka has shown that the archaeological record of late-glacial Beringia is much more complex than we previously thought, and that tying specific archaeological complexes to migration events is at best problematic. Nonetheless, in this paper I will attempt to present a peopling scenario that reconciles current archaeological and genetic evidence.

The phylogeography of mtDNA variation in Altaian Kazakh populations.

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The Altaian Kazakhs, a Turkic speaking group, have continued their seminomadic lifestyle within the northeastern part of the Altai Republic of southeastern Russia. According to historical accounts, they are one of several ethnic and geographical subdivisions of the Kazakh tribal group that migrated from China and Western Mongolia into the Altai region during 19th century. However, the population history of Altaian Kazakhs and their genetic relationships with other Turkic speaking groups and neighboring populations is not well understood. To elucidate their genetic history, we analyzed the mtDNAs from ~360 individuals who resided in three villages (Cherniy-Anui, Kosh-Agach, Turata) located in the southern Altai region. The combination of SNP analysis and HVS1 sequencing revealed significant genetic diversity in this population. Its mtDNA gene pool was comprised of roughly equal proportions of East (A-G, M7, M13, Y and Z) and West (H, HV, pre-HV, R, IK, JT, X, U) Eurasian haplogroups, with the haplotypic diversity within haplogroups C, D, H and U being particularly high. This diversity likely reflects the complex interactions of the Kazakhs with other Turkic groups, Mongolians and indigenous Altaians. In addition, there were considerable differences in the genetic diversity within the three villages, both in terms of the frequencies of haplogroups B, C, D, F, H and U, and the presence of village specific haplotypes. The observed patterns of genetic variation have important implications for Kazakh population history, the genetic prehistory of the Altai-Sayan region, and the phylogeography of Turkic-speaking groups in Eurasia.

Whole mtDNA genome analysis of ancient African lineages.

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Studies of human mtDNA genomes demonstrate that the root of the human phylogenetic tree occurs in Africa. While two African mtDNA lineages (haplogroups M and N) differentiated into all other global lineages, the most ancient mtDNA haplogroups (L0, L1 and L2) are limited to sub-Saharan Africa. Several of these haplogroups occur most frequently in eastern Africa (L0a, L0f and L1e), while others are specific to certain ethnic groups. For example, haplogroups L0d and L0k have been found nearly exclusively among southern African "click" speakers. However, global studies of mtDNA genome variation have included few African mtDNA lineages, particularly from eastern Africa, making it difficult to infer relationships amongst these haplogroups or to examine evolutionary events that occurred early in human history.

We analyzed 112 mtDNA genomes of Africans representing the L0, L1, L2 and L3 haplogroups. Using these data, we infer relationships amongst haplogroups, increase the resolution of the human phylogenetic tree and estimate the TMRCA of haplogroup lineages. These data suggest that East Africans have high genetic diversity, with divergent lineages from nearly all the African haplogroups. We observe shared L0d lineages in the southern and eastern African "click" speakers, suggesting a common ancestry. We further observe a close genetic connection of a subset of L3 lineages from East Africans with non-African haplogroups. These data suggest that a large human population has persisted in eastern Africa and imply that eastern Africa may have been an ancient source of dispersion both within and outside of Africa.

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A biological distance analysis of the Dmanisi molars.

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The Dmanisi specimens represent the earliest evidence to date of hominid occupation outside of Africa. While there are numerous morphological similarities between the Dmanisi hominids and *Homo erectus*, the tool technology found at Dmanisi is more similar to the Oldowan stone tool tradition. Despite this apparent discrepancy, many researchers agree that the Dmanisi specimens represent an initial dispersal of African *H. ex gr. ergaster* that may then have branched into the Asian forms of *Homo erectus*.

This study examines the taxonomic affinities of the Dmanisi hominids through a biological distance analysis of maxillary and mandibular molars. We compared molar measurements from D2282 and D211 (Gabunia et al., 2000; Gabunia and Vekua, 1995) with published data representing *Australopithecus afarensis*, *Homo habilis*, and *H. erectus/ergaster*. After adjusting for body mass, we calculated means to obtain basic size information and performed a multivariate statistical analysis by way of principal components of the molar length, breadth, area, and index.

The findings of this investigation reveal a distinct pattern of evolutionary change for the Dmanisi maxillary and mandibular molars. While the maxillary molars exhibit a more primitive character, the mandibular molars show a more derived pattern in the direction of *H. erectus*. Such a pattern places the Dmanisi hominids in a category by themselves, suggesting a transitional phase to later forms of *H. erectus* from Africa and Asia.

Genetic variation of *Alu* insertions in Easter Island supports "Slow Boats" hypothesis for the peopling of Polynesia.

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Easter Island (Rapa Nui), located at the eastern extreme of the Polynesian Triangle, is the most isolated island on Earth, broadly separated from land masses by

the Pacific. In spite of that, Rapa Nui was settled by Polynesians recently, around 1500 years before present. The human arrival to Rapa Nui and the human settlement of Polynesia, has been studied by archaeologists, linguists and molecular anthropologists, who proposed different models and hypothesis to explain this particular migratory process, such as the "Express Train to Polynesia" from the linguistic evidence, or the "Slow Boats to Polynesia" from the genetic and demographic evidence.

This study tries to characterize the variation of 18 *Alu* polymorphic elements in a well characterized human population from Rapa Nui and in a mixed lineage of inhabitants. Our data confirm the differentiation between the original Rapa Nui lineages from the island and the mixed ones recently originated by migratory events.

Moreover, our work presents the first data on the genetic *Alu* variation in this particular population. We join these results with the available data of *Alu* variation in other populations, to clarify the possible origin of Polynesian settlers, their relationships with Asiatic human populations and the most reliable process to explain the expansion and human settlement of the Polynesia. Instead of the classical "Express Train" model, our data support the "Slow Boats" model proposed by Oppenheimer, which indicates that the pre-Polynesians are mainly derived from Southeast Asian and Wallacean populations prior to the Neolithic "Mongoloid" expansion.

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Epidemic impacts of a changing cultural practice: role segregation among Peruvian men who have sex with men.

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Men who have sex with men (MSM) in Latin America have traditionally practiced role segregation, the adoption of a fixed role (insertive or receptive) rather than a versatile role (both) during sex. However, there is considerable anecdotal evidence that versatility may be on the rise with the diffusion of gay cultural norms from the US and Europe. Here I model the effect of versatility levels on the course of an HIV epidemic among men. The model is structured as a deterministic compartmental model and is parameterized using data from a study of 254 men in Lima, Peru and current estimates for insertive vs. receptive infectivity. 67% of study participants reported segregated roles within their recent male partnerships. A population of MSM with identical contact rates but complete role versatility would have twice the HIV prevalence throughout the epidemic's first three decades. Across many scenarios, a 10% increase in versatility (with no change in overall partners) is equivalent to six more sexual partners per person per year.

Correlates of versatility in a second sample of 2,655 MSM from multiple Peruvian cities include high education, high-status occupation, residence in Lima, and sex work. Since sex work is strongly negatively correlated with high education and status, it appears that the pool of versatile men is dominated by two largely distinct groups: highly educated and elite Limeños, and sex workers generally. Age showed no relationship to versatility in any analysis, hinting that versatility may not be rising as much as popularly believed.

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Size dimorphism in *Australopithecus afarensis*, modern humans, and the great apes: a non-template multivariate comparison.

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Analyses of size dimorphism in the fossil record have usually been limited to single variables due to missing data. Recently, template methods have been used to include multiple variables, but these methods are flawed because they assume perfect isometry between all variables in an analysis. This study analyzes dimorphism in *A. afarensis* and living hominoids using a multivariate resampling technique that does not assume any particular scaling relationship between variables.

The data set comprises eight variables from the fore- and hind-limb represented in *A. afarensis*, *Homo sapiens*, *Gorilla gorilla*, *Pan troglodytes*, and *Pongo pygmaeus*. A bootstrap procedure is used in which a comparative sample of the same size as the fossil sample (*e.g.*, measurements from three elbows, six femoral shafts, *etc.*) is randomly resampled with replacement for each species; geometric means are then calculated for both the maximum and minimum values of each variable and then the ratio of the two geometric means is generated. This procedure is repeated 10,000 times and the resulting distributions of ratios are compared to the fossil value. A second bootstrap procedure is used in which the fossil values are also resampled.

Results of the first analysis are consistent with published results for similar univariate analyses: dimorphism is significantly greater in *A. afarensis* than in all comparative taxa except gorillas (alpha=0.05). When fossil data are resampled, *A. afarensis* does not differ significantly from *Gorilla* or *Pongo* (P>0.442), is significantly greater than *Pan* (P=0.028), and borders on significance with respect to *Homo* (P=0.064) (all two-tailed tests).

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Frequency and patterns of trauma in the medieval cemetery of St. Helen-on-the-Walls, York, England.

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The presence of trauma in archaeological populations can assist in the reconstruction of past social and economic environments. For populations leaving few written documents and material possessions, these lesions are particularly important in the evaluation of health and disease. The medieval cemetery of St. Helen-on-the-Walls, York (ca. 1100-1550 A.D.), associated with an economically impoverished parish within the city walls, yielded 1014 skeletons. Analysis of the material indicates that 100 individuals (9.86%) display traumatic lesions, with the cranium being most commonly affected (29% of the individuals with trauma display cranial lesions, representing 4.7% of all individuals in the population with recovered cranial material). Additionally, 15% of individuals with traumatic lesions display rib fractures, 14% display injuries to the hands or feet, 11% display fractures of the ulna, 10% display fractures of the radius, 8% display fractures of the tibia, 7% display fractures of the fibula, and 5% display fractures of the femur. For both cranial and postcranial elements, almost twice the number of males than females displays traumatic lesions. These data are compared to other British medieval skeletal populations to determine the extent to which economic conditions, occupational hazards, and gender played a role in the presence of trauma.

Testosterone and marriage among Ariaal men of northern Kenya.

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Recent studies suggest that differential human male investment in mating (male-male competition and mate seeking behavior) and parenting effort may be associated with variation in testosterone lev-

els. Indeed, a growing body of North American research shows that men involved in affiliative relationships with a female partner and direct paternal care tend to have lower testosterone levels. Here, we extend the cross-cultural scope of this research to Ariaal pastoralists of northern Kenya. The Ariaal present an interesting test case because marital relations tend to be aloof and direct paternal care minimal by cross-cultural standards, polygyny is prevalent and increases with age and the age set system highly structures the transition to marriage. To test predictions, we recruited 205 men aged 20 and older from both a settled agropastoral community and nomadic populations. Each participant provided morning and afternoon saliva samples in which testosterone levels were measured, provided demographic background during interviews and had anthropometrics taken. As predicted, during the dynamic ages (20-39) of transition from life as a bachelor and warrior to monogamous marriage, men with one wife had significantly lower testosterone levels than unmarried men. Contrary to prediction, however, polygynously married men did not have higher testosterone levels than their monogamously married counterparts. These results held after controlling for potentially confounding effects of age, body composition and residential status. These data lend further support to the framework that male testosterone levels reflect, in part, variation in male mating and parenting effort.

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Phylogenetic analysis of the *tprC, D, I, K, G*, and *J* genes in the genus *Treponema*.

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The pathogenic treponemes include three *Treponema pallidum* subspecies, *T. carateum* (pinta), *T. paraluiscuniculi* (rabbit syphilis), and an unclassified simian isolate. *T. pallidum* subsp. *pallidum* is the causative agent of human venereal syphilis and *T. pallidum* subsp. *pertenue* and *T. pallidum* subsp. *endemicum* cause yaws and bejel, respectively. Although these treponemes are highly related antigenically, they cause distinct clinical diseases, suggesting important genetic differences.

The *tpr* (*Treponema pallidum* repeat) gene family codes for antigens that play an important role in the immune response against *T. pallidum*. Three subfamilies can be identified in which the gene products from Subfamilies I (*tprC, D, F, I)* and II (*tprE, G, J*) have conserved amino and carboxyl terminal sequences with unique central regions, while Subfamily III (*tprA, B, H, K, L)* has scattered conserved and variable regions.

In order to investigate the evolution of this gene family and the treponemes themselves, we constructed phylogenies based on maximum likelihood methods using PAUP*. We used *tprC, D, I, K, G,* and *J* sequences from several strains of the three *T. pallidum* subspecies as well as from the rabbit and simian treponemes. The evolution of these genes appears to be largely due to multiple gene conversion events that occurred after the gene duplications that created the gene family. We were able to determine directionality of three gene conversion events between *tprC* and *D* and to tentatively identify five gene conversions at *tprG* and *J*. Sequences from *tprC*, *I* and *K* support the following order for evolution of the human treponemes: subsp *endemicum*, followed by *pertenue* and *pallidum*.

Mixed longitudinal growth of agropastoral children in northern Uganda.

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From August thru mid-December, 2004, dietary observations, nutritional and health assessments, and anthropometric examinations were carried out monthly among a sample of 28 Karimojong women and 105 of their children. The children were born between 1990 and 2004, and birth dates could be firmly established for the entire sample. Additionally, thirty-six of the children and their mothers were measured in a previous cross-sectional study, carried out in this population in 1998-99.

With the exception of breastfed infants (N=27) younger than age 6 months, all children in the sample exhibited slow physical growth and development. The sample fell at or below the third percentile of NCHS growth standards in length or height, and most also were thin for their stature. Little gain in either length or weight was observed among infants and toddlers during the 4.5 months of the study. Some infants lost weight, and cases of acute malnutrition in the form of kwashiorkor and marasmus were diagnosed among children younger than age 5 years. In young children, delays were observed in key developmental landmarks, including crawling and walking, whereas none of the children aged between 13-to-14 years exhibited any signs of pubertal onset.

Slow and stunted growth in this sample is an effect of mild-to-moderate protein malnutrition compounded by recurring diarrheal and respiratory infections and multiple infestations by intestinal worms, scabies, fleas ("jiggers"), and other parasites. In older children, particularly girls, effects of chronic low-level infections and nutrient deficiencies are likely exacerbated by heavy work demands.

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Limb joint size proportions in *Australopithecus afarensis* and *Australopithecus africanus.*

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Based on their analyses of body proportions, McHenry and Berger (1998) argued that *Australopithecus afarensis* possessed more human-like limb proportions than *Australopithecus africanus*. Due to the error involved in estimating limb length and body size, however, support for these conclusions has been limited. For this study we used resampling methods to test their hypothesis and assess the statistical strength of the species differences.

We used bootstrap analyses to impose sampling constraints that artificially reduced extant ape and human distributions of joint measurements to sample sizes comparable to the fossil samples. Composite ratios of fore and hindlimb geometric means were built by resampling elements from the reduced samples. Mean composite ratios were statistically indistinguishable (alpha=0.05) from the actual ratios of extant individuals, indicating that this method conserved each sample's central tendency. When applied to the fossil samples, joint proportions in *A. afarensis* were similar to those of humans ($p=0.851$) and significantly different from chimpanzee and orangutan proportions ($p<0.02$) while *A. africanus* was more similar to all apes ($p>0.225$) and significantly different from humans and *A. afarensis* ($p<0.04$).

These results strongly support the contention that *A. africanus* possessed more ape-like limb joint proportions than *A. afarensis*, indicating that *A. africanus* might have evolved from a more postcranially primitive ancestor than *A. afarensis*. Conversely, it is also possible that the ape-like limb joint proportions in *A. africanus* were secondarily derived, suggesting they remained under stronger selection for arboreal postures and locomotion than *A. afarensis*.

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Diet at Predynastic Hierakonpolis: an examination of macrowear, microwear and caries.

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While the archaeological record can tell us what foods were available to a population, it cannot reveal whether all members of a group consumed the same diet. This study examines 196 individuals from the Predynastic working class cemetery (HK43) at Hierakonpolis Egypt in order to determine whether males, females, and juveniles shared a similar diet. The burials, as determined through pottery date to Naqada II. Sub-adults account for 16% of the sample. Forty-six percent of the adult sample is male and 54% is female. Methods for determining diet include macrowear scores for the maxillary and mandibular first and second molars; microwear for the phase II wear facet of the second molar, and carious lesion frequency and severity for all teeth.

This analysis shows that while the diets are very similar for all individuals, there are dietary differences between males and females at this site. The dentition of males tends to wear at a significantly faster rate than females. Juveniles are shown to have a diet very similar to that of the adults, the only significant difference being in the number of juveniles who exhibit polish on their micrographs. Data from macrowear, microwear and caries is compared to known available foodstuffs from Predynastic Egypt in order to determine the most likely cause of the patterns seen.

This project was supported by a National Science Foundation grant (BCS-0119754) awarded to Dr. Jerome Rose at the University of Arkansas.

Exploring weaning patterns in the Byzantine monastery of St. Stephen's.

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Stable isotopes and trace element levels from skeletal remains were utilized in reconstructing weaning patterns for the children found at the Byzantine (5th-7th C) monastery of St. Stephen's in Jerusalem. Bone chemistry data were collected from the right femora of fifty-six specimens ranging in age from newborns to young adults. Inductively coupled plasma-mass spectroscopy (ICP-MS) was used to collect strontium, calcium, and phosphorus values. The Ca/P ratio and yields of extracted proteins showed that the bone is well preserved, with a ratio of 2.14:1 for the majority of samples. In addition, mass spectroscopy was employed to determine $\delta^{15}N$ values, which were approximately 2-3‰ higher than the adults, indicative of breast milk consumption. This nitrogen peak and subsequent decline follows expected breastfeeding and weaning patterns as described by Schurr (1998). The combined data suggest that weaning occurred from approximately six months to two or three years of age, a range coinciding with historical accounts describing the introduction of new foods and tooth eruption for children.

These data were part of a larger reconstruction to explain the presence of the sizeable group of subadults at St. Stephen's. Textual evidence indicates that monasteries of the period served as schools, training establishments for young monks (oblates), hospitals and/or orphanages. The presence of several young girls as well as many children under the age of three indicates that the monastery did not function in instructing oblates or as a school; instead, the weaning data, paleopathological survey, age profile, and dentition suggest the existence of an orphanage or hospital.

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The correlation of joint shapes to the movement patterns of the human fibula.

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The fibula remains a mystery of functional anatomy. It sits alongside the tibia articulating with a presumably mobile, synovial, proximal joint and a seemingly less mobile, syndesmotic, distal joint. Yet, what are the functional mechanisms that would require mobility at one end and immobility at the other? A previous presentation (Greiner, et al. 2004) showed that the human fibula moves in response to ankle motion, but does so with several different patterns. Where some fibulas laterally rotate others rotate medially, where some translate in a superior direction others do not. The aim of this presentation is to explore the morphological basis for these movement patterns.

Conventional interpretations of ankle functions assert that the wedging of the trochlea talus drives fibular movement. Presumably as the ankle moves into dorsiflexion the anteriorly widening trochlea forces the fibula away from the tibia until ligamentous restrictions prevent further motion. Our attempts to correlate measurements of trochlear wedging to observed fibular movement patterns show that this relationship is tenuous at best. We found that individuals with the most extreme trochlear wedging (both the greatest and the least measured values) exhibit a similarity of fibular movement patterns to the exclusion of those individuals with intermediate values. Movements of the fibula cannot be explained solely by the shape of the talus. Other features of this complex joint system need to be explored in order to explain why the fibula moves the way that it does.

Investigating the internal structure and function of the Shanidar 3 second pedal phalanx.

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Results of metrical comparisons made between Neandertal and modern human lateral pedal proximal phalanges (2-4) reveal that at diaphyseal midlength, the phalanges of the former are mediolaterally (ML) wider relative to their respective dorsoplantar heights (DP). This has led some to suggest that Neandertals habitually traversed over more rugged substrate or as more recent evidence indicates, Neandertals went unshod. The current study uses computed tomography to evaluate whether cross-sectional geometry of cortical bone and trabecular architecture reflect greater relative strength in the mediolateral direction of the Neandertal specimen, Shanidar 3, compared to modern human males (n = 20). Cross-sectional properties at midlength comparing bending strength in the mediolateral and dorsoplantar planes were matched with external measurements; and the trabecular architecture of spherical volumes of interest (VOI) near the proximal 1/3 of each phalanx were quantified to determine primary direction of loading.

Preliminary results indicate that while cross-sectional properties (Zy and Zx) are not reflected in corresponding external measurements (ML and DP) in this sample ($r2 = 0.057$, $p=0.159$; $r2=-0.0467$, $p=0.701$, respectively), the Shanidar 3 phalanx has a significantly greater relative mediolateral bending strength (Zy) than the sample of modern males. However, analysis of the trabecular bone of Shanidar 3 reveals that strutting is not preferentially oriented in the mediolateral plane compared to the dorsoplantar plane; thus, in this respect Shanidar 3 cannot be distinguished from the modern human sample. Further investigation of cross-sectional properties and trabecular architecture will improve our understanding of biomechanics in this region of the forefoot.

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An investigation of amino acid racemization as a method for estimation of age-at-death of skeletal remains.

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One of the most pressing problems in palaeodemography is adult age estimation. Existing morphological and histological techniques often produce very broad age ranges and show bias in age estimation of young and old adults. As a result, there is a real need for the development of new techniques, which could potentially improve the accuracy of age estimation. This paper will describe a potential new technique currently being trialled to ascertain age at death for adult skeletons. Using a minimally destructive sampling technique to extract proteins from enamel, the extent of amino acid racemization in these proteins was determined for modern known age teeth. A log linear correlation was observed between age and extent of racemization. However, the rate of racemization appears to vary slightly between individuals, resulting in greater deviations from linearity in older individuals. No bias in the direction of age estimation errors was observed. These results indicate that amino acid racemization has the potential to be used in age estimation of skeletal remains, but is unlikely to prove more accurate than existing age estimation techniques. As the mechanism of racemization is unrelated to the degradative processes used in other age estimation techniques, it could be of particular use in multifactorial age assessment methodologies.

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Lower limb proportions and locomotor biomechanics in the genus *Homo.*

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It is not known whether, or how, the dramatic variation in early human body proportions during the Pleistocene influenced locomotion in fossil *Homo*. Changes in gait mechanics related to variation in body proportions have profound implications for Pleistocene human fossil morphology and the evolution of human locomotor behavior. Long tibiae, like those of *Homo ergaster,* could cause increases in sagittal bending forces on the lower limb during walking. If so, we might expect changes in gait or musculoskeletal stabilization mechanisms to compensate. This research is the first to address this question.

Kinematic and kinetic data were collected during free walking for 27 adult human subjects. Tibia length was tested for association with a number of gait variables, including bending moments at the knee and femoral and tibial midshafts.

I found that during the first half of stance phase, individuals with longer tibiae do incur greater bending stresses on the lower limb. For example, the Kendall's correlation between tibia length and sagittal bending moments is 0.396 at the tibial midshaft, 0.368 at the knee, and 0.436 at the femoral midshaft ($p<0.05$). During the second half of stance, however, individuals moderate bending moments through a complex of compensatory mechanisms.

If this pattern applies to fossil *Homo,* hominins with long tibiae may have experienced higher bending forces along the lower limb during walking, possibly resulting in greater structural reinforcement of joints and diaphyses. These data shed new light on later stages of human locomotor evolution and should be taken into account when interpreting fossil lower limb morphology.

Heading to Jerusalem? Assessing migration and pilgrimage to a Byzantine monastery using cranial nonmetric traits.

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This study analyzed migration at the Byzantine monastery of Saint Stephen's (Jerusalem). The incidence of seven nonmetric cranial traits was tracked in the adult remains of the commingled St. Stephen's collection, which dates to the 5th-7th centuries C.E. These traits included the metopic suture (n = 69), supraorbital notch (n = 105), supraorbital foramen (n = 101), mylohyoid bridge (n = 69), auditory torus (n = 126), tympanic dehiscence (n = 136), squamosomastoid suture (n = 108) and the mastoid foramen (n = 74). As further corroboration, cervical vertebrae were studied for non-metric traits including posterior atlas bridging (n = 53), atlas facet formation (n = 60) and transverse foramen bipartite (n = 165).

The frequencies of the chosen nonmetric traits were contrasted with frequencies found in a large pool of comparative data. Two collections from the Near East were also analyzed (Bab edh-Dhra and Umm el-Jimal) and numerous collections from published literature were consulted. Populations from Western Europe and Asia were considered, in keeping with the historical record of "Holy Land" pilgrimage from those areas.

Statistical analysis was run to determine whether the St. Stephen's community displayed significant differences from local populations. The similarities found between the St. Stephen's community and those of local inhabitants suggest that the monks are native to the Near East. Although considered a major social phenomenon in historical texts, the homogeneity of the St. Stephen's remains indicates that members of this community were from the Jerusalem region.

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Imbricational enamel growth in the Point Hope Inuit: Comparisons and contrasts with other modern human populations (Southern Africa and Newcastle, England).

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The number of days of growth represented by perikymata, growth increments visible on enamel surfaces, ranges from 6-12 days in modern humans (Smith et al., in press). Because of this variability, estimates of linear enamel hypoplasia timing, and especially duration, based on an average periodicity of 9 days will be inaccurate for teeth at the extremes of the periodicity distribution. Recent work (Reid and Dean, in press; Reid and Ferrell, in press) has shown that when periodicities can be determined from histological sections, they are highly negatively correlated with total perikymata counts. In this investigation, we used histological samples from two modern human populations (one from Newcastle, the other from Southern Africa) with known periodicities to determine the relationship between periodicity and total perikymata counts for each tooth type within each population. Then, we test which of these relationships can be applied to a Point Hope Inuit dental replica sample to infer periodicities from total perikymata counts.

To perform this test, we applied regression equations of periodicity on perikymata derived from the Southern African (N=114) and Newcastle (N=115) samples to the Inuit sample (N=65). We determined which regression equations fit best by seeing which equations resulted in consistent periodicities for all the teeth of an individual (periodicities are known to be constant within each individual). By doing so, we found that the Newcastle equations were the better fit for the Inuit sample; thus it is possible to refine estimates of LEH timings for the Inuit by using the Newcastle equations.

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The discovery and early interpretation of *Ramapithecus.*

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The fossil hominoid genus *Ramapithecus* has a lengthy history in paleoanthropological studies and represents perhaps the single best case study of how new methodologies (*e.g* cladistics and molecular studies) and theoretical shifts (*e.g.* the neo-Darwinian synthesis) can affect the interpretation of fragmentary fossil material. This study presents the results of the first phase of a larger project examining the changing place of *Ramapithecus* in higher primate phylogeny.

Ramapithecus was first described and proposed as a human ancestor in 1934 by George Edward Lewis, a graduate student of Yale vertebrate paleontologist Richard Swann Lull, who was collecting fossils in the Siwalik Hills of Pakistan (then India). Lewis named the new species *Ramapithecus brevirostris* and, based on fragmentary dento-gnathic remains, claimed that it was on the evolutionary line leading to *Homo sapiens*. Although Asia was assumed to be the "cradle of mankind" by most scholars at the time the scientific community denied hominid status for *Ramapithecus*, partly as a result of comments and analysis by Smithsonian anthropologist Ales Hrdlicka published in the *American Journal of Science*, the same periodical in which Lewis's description had appeared a year earlier.

While the more recent history (1961 onward) of *Ramapithecus* as a potential early hominid is fairly well known to modern paleoanthropologists, this earlier history is not often discussed. This study remedies this by accessing primary published and unpublished sources, including the Lewis and Lull collections at Yale's Peabody Museum and also the Hrdlicka collection at the National Anthropological Archives.

The purported anthropoid astragalus from Myanmar.

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The amphipithecid primates, *Pondaungia* and *Amphipithecus*, from the late middle Eocene Pondaung Formation in Myanmar (Burma) have been controversial since their initial descriptions. These two genera have been viewed as possible anthropoids, as euprimates, or as non-primates. Beginning in the 1980's, additional evidence of both genera began to appear, including more complete dentitions, but none served to elucidate the affinities of either taxon. In 1997 (Ciochon et al., 2001) the first postcranial specimen of an amphipithecid was discovered and confirmed that at least one of the two genera was a specialized adapiform euprimate.

Recently, an isolated amphipithecid astragalus has been described (Marivaux et al., 2003) and interpreted as an anthropoid. Included among the supposed anthropoid features cited were steep medial and lateral trochlear facets and a medial trochlear facet limited in extent and lacking a cotylar fossa. Re-analysis of this astragalus fails to confirm the presence of any derived characters linking it with anthropoids or haplorhines. The lateral trochlear facet is flattened initially but then slopes to a distinct lateral projection resembling extant *Otolemur*. We concur that a cotylar facet is absent but cotylar fossae are present in the most primitive known anthropoids *Proteopithecus* and *Catopithecus* rendering its absence in amphipithecids phylogenetically meaningless. In contrast, derived features such as a concave proximal medial trochlear surface and a centrally placed sustentacular facet are derived features linking amphipithecids with adapiform euprimates. In short, all known postcranial evidence of amphipithecid primates supports the inclusion of these taxa within Adapiformes, not Anthropoidea.

Virtual reconstruction of hominid crania: possibilities and limitations.

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We explain how statistical procedures of missing data estimation relate to effective paleoanthropological use of incomplete and distorted crania. Digital data resources combine with geometric-morphometric methods into new procedures for handling fossil specimens that go beyond the mere assembly of fragments. Using landmarks, several hundred semilandmarks, and information from complete specimens it is possible to estimate missing parts and correct for distortion simultaneously.

Any reconstruction requires assumptions about functional constraints, integration and symmetry, sometimes about gender, species affinity and taphonomy. When such assumptions are stated explicitly, their validity can become subject to evaluation and discussion. As different assumptions and algorithms lead to different estimations, there exists no "all-purpose" reconstruction, instead one creates multiple reconstructions. Implicitly formalizing biological knowledge about integration, symmetry and curvature-smoothness, we present two iterative approaches to reference-based reconstruction: (1) *geometric reconstruction*, using the thin-plate-spline bending-energy based on a single reference specimen, and (2) *statistical-reconstruction*, exploiting the covariance-matrix of a reference sample.

We exemplify these tools using a dataset of several hundred extant hominoid crania to reconstruct *A.africanus* specimens Taung, Sts5, Sts71, Stw505, and MLD 37/38. We discuss principles of reconstruction, and show that the choice of method depends both on the availability of a reference sample and the scientific context in which the estimation will be used. Because statistical reconstruction is regression-based, linear relationships within the covariance-matrix are "overfitted". Thus, for inference from the covariance-structure (e.g. principal-components), it makes sense to use geometrical reconstruction, even when a reference population is available.

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The 1849 and 1854 cholera epidemics in Buffalo, New York.

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Cholera was one of the most feared diseases of the 19th century. It appeared to strike randomly, and it killed quickly, often within hours. The cause of the disease was unknown, but generally attributed to miasmas.

Data for this study was obtained from the records of the Health Physician for the city of Buffalo. There were strict guidelines for physicians in diagnosing and reporting cases of cholera. Only those individuals with a street address are included in this report.

Cholera cases were reported throughout the city but the majority of cases and deaths occurred along the waterfront, an area described as similar to Five Points in New York City, and in "the flats" (80%). The Flats was uninhabitable until construction of the Erie Canal which helped drain the swamps and bogs here. The population increase following completion of the Erie Canal (8,688 in 1830 to 74,214 in 1855) resulted in rapid development and overcrowding in both areas. There were multiple avenues for cholera to spread. A partial list includes high population density, poverty, cesspools, unpaved streets, and inconsistent clean water supply. Waterways throughout the city served as dumping grounds for everything from household wastes to dead animals and human bodies.

Following the 1849 epidemic, in which there were about 2,500 cases of cholera in approximately three months, the city began to upgrade its sewerage system, increased its vigilance of 'nuisances', and enacted other sanitary measures. By the time the 1854 epidemic struck, enough progress had been made such that the

number of cholera cases had been cut in half to about 1,200 but death rates remained high (80%) along the waterfront and in the Flats.

3D-computer assisted reconstruction of the Stw 431 (*Australopithecus africanus*) pelvis

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The partial skeleton of Stw 431 from Sterkfontein Member 4, South Africa, is one of the best preserved *Australopithecus africanus* fossils, consisting of many fragments of the pelvis, the ten last vertebrae and an upper limb. This makes it a key specimen for the study of the evolution of human bipedalism and obstetrics. Being one of the largest fossils from Sterkfontein, it seems to be a young adult male, although degenerative processes are already recognisable. In contrast to the slightly more complete AL 288-1 (*A. afarensis*) and the subadult female Sts 14 (*A. africanus*) partial skeletons, the remains of the Stw 431 pelvic girdle are neither crushed nor plastically deformed. This greatly helps in an accurate reconstruction. A problem in former reconstructions had been the correct orientation of the iliac blades, because the auricular surface was missing on both sides. Iliac orientation, however, is important for lateral stabilisation during bipedal walking. Crucial is therefore the recent discovery in a museum drawer of additional fragments of the ilium which allow joining the left acetabulum fragment with the sacrum. For the present reconstruction all fragments have been computer tomographed using a Philips Tomoscan. With the help of the software environment IDL (Interactive data language, RSInc, Boulder, Co) parts that are missing on one side have been mirror imaged from the opposite side. Shape analysis of the Stw 431 pelvis and those of Sts 14 and AL 288-1 allowed analysing sexual and interspecific dimorphism within *Australopithecus*.

Mid-facial climatic adaptations of indigenous Alaskans (Aleut, Inuit and Northern Athapaskan) and people of the Northwest coast.

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Alaska offers some of the harshest environments to which modern populations have adapted and its ethnic and geographic diversity provide an opportunity to examine theories of climatic adaptation. In this paper I contrast cranial measurements of three skeletal samples from Alaska with four from British Columbia and two from Oregon to examine theories of nasal adaptation to climate stresses. Clustering the nine samples by temperature and humidity links Wales Inuit with Ingalik Northern Athapaskans; Kagamil Island Aleut with Canadian Haida and Bella Coola; and Canadian Kwakiutl, Nuu-Chal-Nuth, and Coast Salish with Oregon Penutian and Athapaskan samples. Congruently, upper facial height, nasal height, interorbital breadth, nasal bone projection, and nasal index of Alaskan Inuit and Athapaskans show similar adaptations to cold, dry climates, both having tall, narrow, non-projecting nasal regions. Aleut mid-facial measures are distinct from those of the other two Alaskan and the British Columbian samples but share specific features with each local group. By contrast, the Inuit differ from all other groups in cranial vault measures, and Northern Athapaskans are similar to southern Oregon Athapaskans, whose nasal measures resemble those of their Oregon coast neighbors. These results support the hypothesis that the midface/nasal region responds to climatic challenges with morphological adaptations, whereas measures of cranial vault reflect ancestry.

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Quantity comparison and number conservation in *Pan troglodytes* and its relation to the structure of the human mind.

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One theory on the structure of the human mind is that it is partially based on numeric logic. In an attempt to discover if this structure is unique to humans a series of three unique quantitative pilot tests (all representing levels of numeric logic) were carried out using *Pan troglodytes* (N=1). The subject was first presented with differing quantities to determine whether she possessed an understanding of quantity. The experiments began by presenting values of one versus zero. After successfully choosing the greater amount five times in a row, successive experiments increased the difficulty of the task (e.g., 3v1, 4v2). Next, the subject was given tasks which would display an ability to make a quantity comparison judgments, retain them, then attach those judgments on to objects where the quantity was no longer discernible. This was done by presenting her with two sets of varying quantities which were covered up before she was allowed to choose the greater quantity (e.g., 1v0, 3v1). Finally, she was given a variation on the Piaget (1966) method to show that despite visual variation, quantity remains the same (conservation of number). In this experiment, the object placement was manipulated in front of the subject to make the quantity appear different from its actual amount. The subject completed all of the experiments successfully; however, the rate of success was lowest on the second group (68%) of tasks versus the first (93%) and third (86%). This data suggests that regions necessary for abstract numeric logic arose before the ape/human split and did not arise *de novo* in modern humans.

A radiographic study of dental development in fetal *Macaca nemestrina*.

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Although the macaque is often used as a model for human dentofacial growth and development, there exists a paucity of data on the calcification of its dentition. Chronologies based on radiographic analysis provide data which are useful to both the experimental biologist and the clinician. The purpose of this poster is to describe the normal development of the deciduous teeth in the pigtailed macaque (*Macaca nemestrina*) and to test whether there are sex differences in the timing of dental calcification.

The sample consists of 74 male and 63 female fetal and neonatal *M. nemestrina* of known gestational age ranging from 60 to 207 days. The average age at birth for this sample is 170 days. In addition, 20 juveniles with fully developed deciduous dentition are included.

Nine stages of dental maturation are identified and given a numerical score. Dental maturation scores for females and males were compared and no significant differences are observed. Average ages of eruption in gestational days are as follows: i^1 84; c^1 92; [i^2, m^1] 97; m^2 112; i_1 86; i_2 96; c_1 98; m_1 101; m_2 110. At 170 days, the crowns of the deciduous incisors, canines and first molars are complete and the calcification of the first permanent molar has begun.

Dental maturation scores are plotted against age and Step-wise regression equations predicting age are formulated using the individual dental maturation scores and the total scores. Age is most reliably predicted using the score for i^1 in combination with the score for i_2.

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Interpretations of the cranial variation and diversity in Arctic peoples

from Northeast Asia and North America

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The present study is an assessment of the diversity and morphological variation of 85 Arctic populations from Northeast Asia (Chukchis, Asian Eskimos, Ekvens), Aleutian Island chain (Aleuts), Alaska, Canada, and Greenland (several Eskimo groups) by analyzing metric and nonmetric cranial data. Thirty-four measurements and 20 discrete traits were recorded from each cranium. The two morphological systems demonstrate that the Arctic populations show separation from neighboring groups such as Native Americans and East Asians, as well as diversity among themselves. The relatively large inter- and intra-group variation of Arctic populations are also indicated by using the R-matrix method (including the estimation of *Fst* values). Such findings can be interpreted as a combination of genetic drift, gene flow, natural selection, and/or multiple origins. To determine what combination of these factors could be responsible for the morphological uniqueness of contemporary Arctic peoples, we applied a model-bound approach developed by J. Relethford and colleagues. The results obtained suggest that the classic model-free analyses, in which the Arctic people appear to be outliers relative to the neighboring populations as represented by Native Americans and East Asians, may be attributed to genetic drift as a result of small long-term effective population size.

Climbing energetics in primates: body size considerations.

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Large and small primates regularly move within 3-dimensional arboreal environments, often up vertical supports. Taylor et al. (1972) found that the energetic costs of climbing relative to horizontal locomotor cost are greater in large than small animals, suggesting that climbing is expensive for large primates. Few studies, however, have examined climbing costs in mammals and most are limited to inclined rather than vertical supports. This study represents the first documentation of climbing energetics across body size in primates and examines whether climbing is relatively more expensive in larger primates.

Climbing energetics were collected over an 8-fold increase in body mass (0.160kg-1.35kg) for: *Loris tardigradus*, *Cheirogaleus medius*, *Nycticebus pygmaeus, Saimiri boliviensis*, and *Eulemur mongoz*. Subjects climbed a vertical rope-treadmill at their maximum sustainable speed for 10-20 minutes while in a chamber attached to an oxygen analysis system. Data were compared to predicted horizontal metabolic rate using Taylor et al.'s (1982) equation.

Results support Taylor et al. (1972), specifically that gross climbing metabolic rate was similar to predicted horizontal costs for small primates (<0.5kg) and nearly double for larger species. However, net climbing efficiency, a measure of relative cost, did not vary significantly with size ($p = 0.53$; mean net efficiency = 13.8%). These data suggest that although large primates use absolutely more energy to climb than small primates, the relative amount of work accomplished per unit energy is proportional to small primates. In this way, contrary to expectations, large and small primates are able to climb with similar relative costs.

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Cave versus open-air sites: comparisons, differences, and biases

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Understanding hominin environments and subsistence strategies involves the analysis of faunal remains. However, overall faunal representation is impacted by depositional environment. Factors relating to bone accumulation and preservation differ between depositional systems, producing disparate taphonomic histories. Two broad depositional regimes characterize paleontological assemblages in Africa: karstic (cave) and open-air sites. Paleoecological and subsistence data obtained from these two types of sites are commonly compared without a clear understanding of the preservational implications between the two depositional systems. This analysis examines the mammalian faunal lists of cave and open-air assemblages, drawn from African Plio-Pleistocene sites of differing environments and time ranges, to test for systematic biases affecting site comparisons. Sites are analyzed with taxon-free methods, and attributes including proportions of families and body size classes are compared.

Results indicate that there are differences in both size class and taxonomic representation at the family level between cave and open-air sites. Cave settings preserve significantly greater proportions of small mammals, while larger animals (size classes 3, 4, and 5) are rare. Open-air sites have a more even size class distribution, with the exception of the lack of micromammals and the dominance of size class 2 animals. Both cave and open-air sites are dominated by bovids, which account for approximately one third of the species represented. Differences were also found in the proportions of suids and carnivore families. Faunal comparison over the large geographic areas inhabited by hominins should take into account systematic preservational differences resulting from different depositional environmental conditions.

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Lower-limb joint morphology and adaptation in the Point Hope collection: New evidence using geometric morphometric techniques.

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The relationship between modern human skeletal morphology and climate, particularly with respect to cold-adapated populations, is well documented and discussed. Much of this work has relied on quantitative variables such as limb proportions and robusticity indices. However, there has been very little work using modern geometric morphometric techniques to explore the relationship between the actual three-dimensional shape of limb bones and climate. The skeletal samples from the Point Hope Collection provide an invaluable chance to conduct such research.

In this study, homologous landmarks were designed to quantify the morphology of the proximal and distal ends of the femur and tibia. Most landmarks relate to the morphology of the articular surfaces or muscle attachment sites. Landmarks were collected using a Microscribe digitizer, and then subjected to a Generalized Procrustes Analysis, which is a superimposition technique that adjusts for size. The sample consists of 25 Point Hope, 14 African Americans, 19 White Americans, 13 South-West Native Americans and 10 Egyptians.

Results from PCA show that the Point Hope sample distinctly clusters from other modern human populations for both the tibia and the femur, although more so for the tibia. For the femur, the clustering is mainly explained as an effect of allometric scaling. However, this is not the case for the tibia, whose relatively short length and large joint surfaces were found to be related to climate. This apparent difference in signals from different elements of the lower limb is discussed in the context of postcranial variability, activity patterns and climate.

Mortality profiles for early 20th century African American communities.

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Patterns of mortality and morbidity for African American communities from the early 20th century are rooted in the economic, political, and social trends of the period. This study examines the paleodemographic structure of the Providence Church Cemetery sample (40SY619, n=62), from Shelby County, Tennessee. Comparisons are made to Shelby County mortality records and other regional African American cemetery samples, which have been identified as representing rural and urban communities.

Paleopathological investigations of the Providence sample document a pattern not clearly indicative of Davidson and colleagues' (2002) expectations for rural and urban localities. In this study, paleodemographic analyses are used to compare Providence with other African American communities to determine differences in mortality rates between these localities.

Prior studies examined differences in mortality rates between rural and urban populations using life table approaches. Many researchers have expressed concern over the limitations of the life table method. Computer simulation and maximum likelihood estimation to model population structures and the use of hazard models for skeletal samples have the potential to overcome these limitations. For this study, proportional hazards models of mortality are used for estimating the age at death distribution from the Providence sample. The paleodemographic distribution is then compared to two contemporaneous samples, Freeman (N= 885), located in urban Dallas, Texas, and Cedar Grove (N=80), in rural Arkansas.

This study demonstrates the utility of new paleodemographic techniques as a means to complement other bioarchaeological research evaluating the effects of social and economic conditions on the morbidity and mortality of early 20th century African American communities.

Morphological variation among early hominin proximal femora.

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Skeletal variation among Plio-Pleistocene hominins has potential implications for taxonomy and adaptation to bipedality. While sample size constraints make systematic interspecific comparisons difficult, some skeletal differences between *A. afarensis* and *A. africanus* have been reported. Additionally, some evidence suggests that early *Homo* skeletal material is not distinct from that of *Australopithecus*. Recent fieldwork has increased the sample size of proximal femora in *A. afarensis*. On the basis of the larger sample, the morphology of the *A. afarensis* proximal femur can be newly characterized and compared to the femora of extant hominoids and other fossil taxa.

Linear measurement and three-dimensional landmark data are collected from a large sample of fossil and recent hominoid proximal femora. In addition to the enlarged collection of *A. afarensis* proximal femora, the fossil sample includes original material from *Australopithecus*, *Paranthropus*, and early *Homo*. The data are analyzed with traditional and geometric morphometric methods.

The results indicate that femora of *A. afarensis* differ from *A. africanus* and *P. boisei* in neck length, neck breadth, and neck-shaft angle. Other aspects of morphology are shared with *A. africanus* or with *P. robustus*. Early *Homo* morphology is like that of recent humans in some respects, but similar to *A. afarensis* in others. These results suggest that variation among early hominin proximal femora is more complicated than previously known, and that the femora attributed to early *Homo* are not obviously better assigned to *Australopithecus*. The implications for taxonomy and adaptation are explored.

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The origin of syphilis: a phylogenetic approach suggesting New World origin.

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Since the first recorded epidemic of syphilis in 1494, the world has argued about the origins of *Treponema pallidum* subsp. *pallidum* and its relationship to the agents responsible for the other treponemal diseases: yaws, endemic syphilis, and pinta. Some have speculated that syphilis arose from a pathogen acquired in the New World by Columbus and his men. Alternate hypotheses have been proposed, including: 1) the various treponemal diseases are simply different manifestations of a single pathogen found world-wide; and 2) syphilis was always present in Europe, but was previously confused with other diseases such as leprosy. A review of the geographical span of the treponematoses over time, as revealed in the paleopathological record, has demonstrated that evidence of treponemal disease is abundant in the Pre-Columbian New World and seemingly absent from European and North African sites. However, isolated reports of treponemal disease in these areas before the 1490s have kept the controversy alive.

We apply phylogenetics to the twin problems of the origin of subsp. pallidum and its relationship to the other subspecies. Based on a phylogenetic tree created from the concatenated sequences of multiple polymorphic sites, obtained from *T.p.* subspecies from a world sample, we report that the non-venereal subspecies appear to be ancestral to the subspecies causing syphilis. In addition, subsp. *pallidum* appears to be most closely related to subsp. *pertenue* strains from AmerIndian populations in South America, lending support to the Columbian theory of syphilis's origin.

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Osteological manifestations of cranial trauma in Liberian Chimpanzees (*Pan troglodytes verus*): Interpreting patterns of male-male and male-female violence.

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Evidence for violence within and between wild chimpanzee communities has been based on observations at a limited number of sites (e.g., Gombe, Goodall 1983; Mahale, Nishida et al. 1995; and Taï Forest, Boesch and Boesch-Achermann 2000). These limitations have restricted our ability to evaluate dynamic patterns of inter- and intra-group violence. Such violence may, however, be recorded as traumatic lesions in the chimpanzee skeleton, allowing us to evaluate patterns of aggression even when the behavior is not directly observed. Previous studies of traumatic lesions have been limited to small samples and have focused on population frequencies rather than risks to an individual based on age and sex. This study analyzes the distributions of antemortem blunt-force wounds on the crania of 250 Liberian chimpanzees. Cranial trauma is present in 58% of this sample, much greater than the 43% reported for a geographic mix of chimpanzees (Lovell 1990), and differing considerably from the 5.5% reported for a sample from Cameroon, and 27% from Gombe, Tanzania (Jurmain 1997). In the Liberian series, multivariate statistics are used to assess individual patterns of injury in correlation with age, sex, and disease load. Male trauma patterns indicate a greater likelihood of face-to-face altercations, while females receive more blows to the back of the head. Trauma inflicted on females also tends to be more severe, as evidenced by a significantly higher frequency of wounds. Infant and juvenile chimpanzees in the Liberian series also exhibit a high frequency of non-lethal trauma.

Age-related changes in trabecular bone mechanical and material properties in baboon vertebrae.

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Until recently, research into bone's resistance to fracture focused on bone mass, a measure of the amount of bone in the skeleton. Studies show, however, that a great deal of fracture risk is independent of bone mass. This has prompted investigations of other measures of bone quality, including direct measures of bone fragility. Mechanical and material properties of trabecular bone are directly related to risk of osteoporosis-related spinal compression fractures, and provide information about bone's ability to withstand mechanical loading without being compromised (fractured). We investigated age-related changes in mechanical and material properties in the baboon (*Papio hamadryas*). The baboon shares physiological and developmental characteristics with humans (e.g., a long lifespan, bone loss with age, lifelong skeletal remodeling, and natural menopause), and thus is particularly well-suited for studies of skeletal maintenance and turnover. We obtained the third lumbar vertebra at necropsy from 15 male and 15 female baboons (5 each in age groups of 5-10, 11-19, and 20+ years). Trabecular cores from the centrum were tested to failure in compression to investigate whether baboons show age-related changes similar to humans in ultimate force, stiffness, work to failure, apparent ultimate stress, elastic modulus, and toughness. Results show a strong age effect on ultimate force, apparent ultimate stress, work to failure, and toughness (r^2 = ~0.60). Each of these fracture-related properties is lower in young animals, increases in middle-aged animals, and decreases in the oldest animals. This pattern of change mirrors that seen in humans and other primates.

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Linkage disequilibrium and haplotype structure of the obesity-associated gene perilipin (*PLIN*).

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Perilipin (*PLIN*; OMIM 170290; 15q26) is a 15kb gene that encodes a hormone-regulated protein responsible for encircling intracellular lipid droplets in adipocytes and steroidogenic cells. Previous studies by Qi et al. (2004, 2005) have shown association between two SNPs in this gene and increased obesity risk in European and Asian populations. To better understand the patterns of genetic variation in *PLIN*, we typed 57 single nucleotide polymorphisms (SNPs) and 2 in/dels spanning the exons (8 synonymous and 5 nonsynonymous polymorphisms), introns, and 3'UTR in 5 populations (African Americans [N=56], European Americans [N=100], Chinese Americans [N=58], and Japanese Americans [N=50] from the San Francisco, CA region, and Mexican Americans [N=299] from Starr County, TX). Substantial LD was observed among the SNPs in all populations (mean D'=0.74) although it was slightly reduced in the African Americans compared to the remainder of the populations. Haplotypes were determined using PHASE 2.0 and their evolutionary relationships were inferred by constructing a reduced median network. Three principal haplotype classes were defined by four SNPs that primarily differentiated Asian from non-Asian haplotypes. F_{ST} values suggest larger than expected differences in the distribution of PLIN allele frequencies between African, Asian, European populations. These results are discussed in the context of association studies between variation at this gene and obesity-related phenotypes.

Fossil data on the evolution of primate orbit orientation and binocular vision.

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Orbit orientation is a critical component of visual field construction in primates as well as in other mammals. It has been hypothesized that orbit convergence (the degree to which the orbits face in the same direction) and its relationship with binocular visual field overlap is the cornerstone of an innovative character complex that is linked to the adaptive origin of primates. Tests of this hypothesis have primarily relied on orbit orientation and ecological data from extant primates and other mammals. Investigating the functional and adaptive significance of primate orbit orientation, however, requires the integration of extant and fossil data to reconstruct the sequence of transformations that led to the evolution of the primate circumorbital morphotype.

This study combines orbit orientation data on extant and fossil taxa with methods of phylogenetic character reconstruction to analyze the sequence of primate orbit orientation evolution. Fossils examined here include several omomyiform, adapiform, and early anthropoid taxa as well as several plesiadapiformes, one possible outgroup to primates. Results demonstrate that using alternate cladistic tree topologies advocated by various workers leads to different reconstructed sequences of orbit evolution. If plesiadapiformes are the outgroup to primates, then several reversals or reductions in orbit convergence relative to other archontans occurred prior to the origin of primates. However, under any advocated phylogeny, several reversals must have occurred in some taxa, such as the diurnal tree shrews. In general, the magnitude of character change in orbit orientation is greatest if plesiadapiformes are accepted as the outgroup to primates.

Charles Merbs and the San Diego Museum of Man.

T.D. Heflin, T. Biers, R.A. Tyson. San Diego Museum of Man.

Charles Merbs' involvement with the San Diego Museum of Man has produced a research and resource base upon which other scholars have built. He researched and described two important collections: The Hrdlicka Paleopathology Collection, with 1000 specimens, and the Stanford-Meyer Osteopathology Collection, with 3500 specimens. His initial descriptions have increased the potential for new research and made it possible for students and scholars to increase the documentation of these resources. The *Catalogue of the Hrdlicka Paleopathology Collection* was published in 1980. Following his work on the Hrdlicka material, he developed two slide sets for teaching and research: *Pathologies from the Hrdlicka Collection* (65 slides) and *Trephined Skulls* (42 slides). Although these were originally published in 1980, they are still in use today by anthropology and medical professors. Charles Merbs has also furthered the educational mission of the Museum by lecturing at various events and seminars. He is acknowledged for initiating the Museum's "Seminar in the Forensic Sciences" a biennial program that continues to this day.

Wealth, status and gender at Bronze Age Tepe Hissar: An investigation of intracemetery variation in dental pathology prevalence in prehistoric Iran.

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Excavations at Tepe Hissar yielded a vast array of artifacts and human burials. Great differences in the number and quality of burial accoutrements and a vast over-representation of males relative to

females led Schmidt to suggest that the inhabitants of this site lived in a highly stratified society predicated on patriarchal power. This study seeks to test these assertions through assessment of the prevalence six dental pathologies to determine: 1.) whether material indicators of social status are accompanied by indications of differential diet and health, and 2.) whether patterns of differential health correspond with patriarchal power.

Dental pathology prevalence among 235 individuals (147 males, 88 females) reveals that males experienced higher prevalence for two pathologies (abscessing, hypercementosis), while females had higher prevalence for four pathologies (antemortem tooth loss, caries, hypoplasia, pulp exposures). Such results suggest a gender-based difference in diet in which females consumed nutritionally poorer cariogenic foods, while males consumed more abrasive diets of better nutritional quality.

Assessment of dental pathology prevalence relative to material indicators of social status reveals weak, but consistent evidence of status-based differences in diet. Individuals buried with more high-quality grave goods tend to have better overall dental health than those accompanied by fewer grave goods. Correspondence between dietary health and material indicators of wealth are higher for males than females. Such results suggest that in the past, as in Central Asia today, social status for males is largely set at birth while social status among females may be negotiated, upward or downward, throughout life.

Platyrrhine dental eruption sequences.

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Platyrrhine dental eruption sequences have never been fully examined. Thus, with the ultimate goal of further extrapolating the Platyrrhine fossil record eruption sequences, 355 mandibles and maxillae of informative juvenile specimens from all 16 extant New World Monkey genera were scored for presence or absence of permanent teeth including three intermediate eruption stages following Harvati (2000).

The timing of molar eruption relative to that of the anterior dentition is variable in Platyrrhines. *Aotus* is highly precocious, with all molars erupting in succession before replacement of any deciduous teeth, while *Cebus* is delayed in M2-3 eruption relative to I1-2. Along this continuum, the early eruption of the molars relative to anterior teeth in *Pithecia, Chiropotes* and *Cacajao,* in comparison to later erupting genera such as *Ateles, Lagothrix* and *Alouatta,* appears to be consistent with current phylogenetic hypotheses. Schultz (1935) postulated early molar eruption as the primitive dental eruption schedule for primates. Therefore the extreme early molar eruption of *Aotus* versus *Callicebus* (where both incisors erupt before M2 and M3, with M3 usually last) may lend support to the status of *Aotus* as a basal taxon. The early molar eruption of the fossil species *Branisella* is also consistent with this hypothesis (Takai et al 2000). Callitrichines have a distinct tendency towards delayed canine and incisor development. Platyrrhine eruption sequences are also discussed relative to dietary and life history variables. Platyrrhine sequences presented here are generally in accordance with Schultz's Rule, showing relatively early replacement of deciduous dentition in slow growing animals.

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On using phylogenetically independent contrasts to identify most parsimonious cladograms

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The reconstruction of relationships among fossil hominins has relied heavily on data from craniodental remains. However, many researchers have raised concerns regarding the extent to which homoplasy in the masticatory system limits the validity of cladograms based on craniodental characters. In an attempt to bypass concerns of homoplasy, I propose using phylogenetically independent contrasts (PIC), using scaling data from masticatory traits to test phylogenies.

PIC is normally used with known phylogenies to test for correlated evolutionary change, or scaling, between two variables. Assuming the scaling relationship does not change within a lineage, it may be possible to use PIC 'in reverse' to test several possible phylogenies, to see which one best preserves this relationship.

To test this method, I used a data set of New World Monkey mandible and M_1 areas. Negative allometry between mandible size and tooth size has already been demonstrated (Lucas, 2004). Likewise, the molecular phylogeny for these species has also been established (Schneider, 2000). Assuming this phylogeny is the "true" phylogeny, I compared its correlation coefficient of the scaling relationship between mandible and M_1 area to those of other phylogenies. Results show that this reverse use of PIC can separate phylogenies based on the value of their correlation coefficient, with the true phylogeny often producing the highest correlation coefficient. When used on a small sample of hominin fossil mandible and M_1 data, however, this method is not stringent enough to determine which phylogeny is the correct one.

Identifying sexually dimorphic patterns in orangutan and gorilla crania.

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Several species within the primate order are characterized by sexual dimorphism. An understanding of patterns of dimorphism assists in interpreting variability within and between both extant and extinct species. The identification and quantification of sexually dimorphic patterns among the primates is a needed area of study.

Three-dimensional coordinate data were collected from 194 orangutan and gorilla crania in order to quantify and compare sexual dimorphism in the highly dimorphic great apes. Data were analyzed using Euclidean Distance Matrix Analysis, in an effort to address the question, how do dimorphic patterns compare between the orangutan and the gorilla? Differences would suggest changes due to adaptation, while similarities would suggest a common growth mechanism.

Results indicate that orangutans and gorillas exhibit similar, but not identical, patterns of sexual dimorphism in the face and palate, i.e. male orangutans are different from female orangutans in many of the same distances that male gorillas are different from female gorillas. Additionally, orangutans are more dimorphic than gorillas in the height of the face and premaxilla, and the length of the molar tooth row. Gorillas exhibit higher levels of dimorphism than orangutans in the width of the upper face, the relationship between the upper face and neurocranium, the width of the posterior palate, and the length of the premolar row. The similar patterns of dimorphism shown between these two groups suggest an underlying common growth mechanism. However, local adaptations also influence final adult form.

Three-dimensional analysis of temporal bone pneumatization.

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Important conclusions regarding hominin phylogeny and craniofacial evolution have included temporal bone pneumatization as a phylogenetic marker. The extent of pneumatization in the temporal bone is reduced in *Homo* compared to other hominins suggesting evolutionary changes in functional requirements. The correct inclusion of this character in studies of human evolution requires a thorough understanding of normal patterns of temporal bone pneumatization in extant species. Adopting three-dimensional

methods from trabecular bone analyses; this study quantitatively compares patterns of temporal pneumatization in humans and African apes.

The study sample consists of adult humans (N=10), chimpanzees (N=10), gorillas (N=10), and bonobos (N=2). High resolution computed tomography scans of the temporal bone were acquired for each specimen with slice thicknesses approximating 100 microns. Using Quant3D and Amira software, bone volume fractions, surface areas and anisotropy measures were collected from each scan and statistically compared among species using Mann-Whitney U-tests.

Results indicate that humans have a different pattern of temporal bone pneumatization compared to other species. Pneumatized regions in human temporal bones demonstrate increased anisotropy with decreased bone volume fractions compared to pneumatized regions in African ape temporal bones, while surface areas of the air cell networks have decreased during human evolution. This study demonstrates that the overall decrease in the extent of temporal bone pneumatization documented in human evolution is accompanied by structural changes in the patterns of pneumatic spaces. Since bone responds directly to biomechanical requirements, different pneumatization patterns observed in human evolution may result from modifications in functional and structural requirements.

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An assessment of compact bone microstructure and its use in differentiating between mammalian species, including *Homo sapiens*.

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This paper will outline a study completed to assess the use of histomorphometric analysis in distinguishing between compact bone tissue of several mammalian species, including *Homo sapiens*. In recent years much research in biological and forensic anthropology has been focussed on the use of histomorphometric analysis of compact bone tissue to differentiate between mammalian species. The majority of these studies have provided methods of differentiation without addressing the variability existing within compact bone due to several intrinsic and extrinsic factors. Bone and bone portion sampled as well as age, sex, activity level and any pathological conditions affecting the skeleton all influence the microstructural appearance of compact bone. Similarly, many mammalian species display the same types of bone tissue with similar-sized structures, despite the differences in their body morphology and/or size.

Examination and comparison of results from published studies of histomorphometric analysis of mammalian compact bone was undertaken and is presented. Further research into the variations of the 'normal' appearance and parameters of compact bone microstructure affected by intrinsic and extrinsic factors is also addressed. As several mammalian species display the same types of bone tissue with overlapping values of histological structures, it is concluded that complete differentiation between the mammalian species discussed cannot be conducted via histomorphometric analysis alone. These mammalian species are classified according to bone tissue type and sizes of histological structures, providing the reader with a series of groups of potential mammalian species based on compact bone microstructure.

Food insecurity is associated with increasing body mass index in rural Costa Rican women.

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Changes in diet and lifestyle associated with the rapid spread of new technologies and a global market economy have a significant impact on the health and nutritional status of many populations worldwide. The findings presented here come from a study of women living in two communities in rural Costa Rica. The community of Santa Elena is currently experiencing a dramatic shift from an economy based on agriculture to eco-tourism while the economy of San Rafael is predominantly characterized by farming. Although women from Santa Elena were significantly taller (156.3 cm) than their counterparts from San Rafael (154 cm; P= .009), there were no significant differences in body weight or body mass index (BMI) when comparing the two groups. The mean BMI for the total sample was 27.6. Nearly 30% of the women were obese (BMI $\geq$ 30). Interestingly, food insecurity, as measured by the Radimer/Cornell scale on hunger and food insecurity, was associated with increasing body weight (OR= 1.17) and BMI (OR= 1.45). Increasing reliance on low-cost carbohydrate dense foods that are high in saturated fat and sugars might explain the paradoxical relationship between food insecurity and obesity.

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Functional axis of the foot in primates estimated using the distribution of plantar muscles.

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The dorsal interossei of the human foot are arranged so that they abduct the digits around the second digit, while those of non-hominoid anthropoid primates are mostly arranged around the third digit. This is thought to be related to the medial shift of the functional axis of the foot in humans. However, it is still unclear how such a change in foot musculature occurred. This study examined the foot musculature, especially the interosseous muscles, adductor hallucis, and contrahentes, in four non-human primates, to investigate its modification associated with the shift in the functional axis of the foot. The results revealed that the 2nd dorsal interosseous could be divided into two portions distally: a dorsal bipennate portion and a plantar portion that inserted into the 3rd digit. The dorsal interossei of the primate foot seem to be composite muscles, and the change in the manner in which the two portions unite resulted in a change in the insertion of the 2nd dorsal interosseous, and consequently in the medial shift of the functional axis. This matches Lewis's (1965) descriptions of the interosseous muscles of primate hands. The contrahentes are reduced in number in spider monkeys and disappeared in chimpanzees; this is possibly related to the more lateral origin of the adductor hallucis in these species, although its functional relationship with the medial shift of the axis is unclear.

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Quantitative and developmental genetic approaches to morphological evolution.

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Advances in both developmental and quantitative genetics have increased our understanding of how skeletal and dental morphology are determined by genetic factors, and how these mechanisms may have evolved throughout organismal evolution. Virtually all of paleontology has been affected by this new synthesis, as the morphology and variation recorded in the fossil record can now be viewed from genomic and genetic perspectives. Fossils provide the data as to where and how evolution occurred. As our understanding of what fossilized morphology represents in terms of the underlying genetics improves, the quality of evolutionary research in the broad sense is advanced. The integration of genetic and phenotypic approaches has similarly enhanced our

understanding of primate evolution, ranging from interpretations of *Australopithecus* facial architecture, the genetic factors leading to bipedalism, cranial size in New World primates, and our understanding of dental evolution. In this talk I will provide a brief overview of the multifaceted integration of genetics into how we interpret and study the primate fossil record.

Microwear of the canine and the incisor of Neolithic Japanese.

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Studies of dental microwear using a scanning electron microscopy (SEM) have made comparative analyses of features of the striations and pits on heavily worn occlusal surfaces of teeth of Neolithic western Japan (e.g., Hojo, 1989, 2000, 2002, 2005). In the present study SEM micrographs were taken from the high-resolution casts of the canine and compared to those of the molar and the incisor from West Kyushu seacoast, and the method of making casts was almost the same as my previous studies. The areas of SEM micrographs at x500 were analyzed using Microwear Image Analyzing Software Version 2.2β (Ungar, 1996). As for the striations, the canine on the labial mesial area showed N = 34, the mean length = 41.6 microns, and the mean breadth = 3.3 microns; the second incisor on the labial mesial area showed N = 25, the mean length = 41.4 microns, and the mean breadth = 1.9 microns. The difference in the breadth of the striation between the canine and the second incisor was significant by t-test ($p < 0.001$). The striations of the canine and the incisor were parallel, and the striations of the canine were thicker than those of the second incisor. Many parallel thick lines on the canine might occur by hard use. This Neolithic Japanese might pull substances with sand grains on the lower canine. Many thick parallel lines were not observed in the second molar of this Neolithic Japanese (Hojo, 2005).

Body proportions of the Point Hope sample.

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Given the well-documented fact that human body proportions covary with climate (presumably due to the action of selection), one would expect the Point Hope Inuit skeletal sample from northern Alaska to be characterized by a cold-adapted body shape. Comparison of the Point Hope Inuit sample to a large (n > 900) sample of European and European-derived, African and African-derived, and Native American skeletons (including Koniag Inuit from Kodiak Island, Alaska) confirms that the Point Hope Inuit evince a cold-adapted body form (e.g., in terms of mean index values for brachial, crural, and limb/trunk indices, the Point Hope and Koniag samples are consistently the most cold-adapted of the groups). Analyses also reveal some unexpected results. For example, while one might suspect the Point Hope sample would show a more cold-adapted body form than the Koniag, given their more extreme environment – this is not always the case. Additionally, while univariate analyses of means consistently show the Inuit samples to be more cold-adapted in body shape than the Europeans, multivariate analyses that include a myriad of body shape variables such as femoral head diameter, bi-iliac breadth and limb segment lengths, fail to effectively discriminate the Inuit samples from Europeans, at least when individuals, rather than sample means, are considered. In fact, in terms of body shape, the European and the Inuit samples tend to be cold-adapted and are separated in multivariate space from the more tropically-adapted Africans, especially those groups from south of the Sahara.

The brain endocast of *Homo floresiensis*: microcephaly and other issues...

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The discovery of a dwarfed hominid living under 20K ago, with a brain roughly 400 ml large, and associated with stone tools of Upper Pleistocene elements has led to considerable controversy regarding the hominid's taxonomic position, possible pathology, and an opportunity to re-assess fundamental assumptions regarding the relationships between brains and behavior, particularly with regard to size. While the original **Science** paper by Falk et al (2005) provided an analysis ruling out pathology, namely microcephaly, the microcephalic endocast chosen was not a good representative of this spectrum of small-brained pathologies. With the cooperation of several colleagues, we have been able to study some 6 microcephalic endocasts, which represent the condition *microcephaly vera*, as well as Seckel's syndrome. Our studies, while unable to rule out completely the possibility of brain pathology in the Flores Island hominid, suggests that none of the microcephalics studied thus far, including one measuring 400 ml, shares any patterns of pathology with the hominid endocast, unless the size alone is taken to be pathological. In addition, we find that the endocast volume is 400 ml, not 417 ml as reported in *Science*, and argue that features of the frontal and temporal lobes described as advanced may instead indicate some form of pathology (possibly microgyria). Gyri on the anterior frontal lobe do not match patterns seen in either normal modern humans, earlier *Homo erectus*, or in the microcephalic endocasts we have examined.

The primates of El Pital Sector, Ecuador: Pilot data suggest a new *Cebus* in Machalilla National Park.

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Ecuador is the native habitat of several Neotropical primates. Some areas, and the primate fauna they support, remain little studied to date, as is the El Pital sector of south-central Ecuador within Machalilla National Park. Because there are human habitations in the park, their impact on the resident fauna cannot be assessed until initial numbers are known and sampled longitudinally. To establish baseline data, I conducted a pilot study between May and August, 2005. Census data were collected on walks of random transects during which the numbers and kinds of primate fauna and their location were recorded. Twenty capuchins (*Cebus* sp.) in 3 groups and 198 mantled howler monkeys (*Alouatta palliata*) in 15 groups were mapped. It may be that living within park boundaries increase their numbers in comparison to unprotected areas. Groups were found between 2 to 11 kilometers distant from human habitations. Each individual in all groups was also photographed. These data suggest that a previously undocumented type of *Cebus* may inhabit the park. Additional data, including fecal and hair sampling are needed to clarify the taxonomic status of this form. Ecotourism is a growing source of income for Ecuador. We suggest that Machalilla National Park is part of this trend because it may protect diversity by reducing hunting pressure on the primate fauna while promoting concurrent economic development of local communities.

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Increased human-chimpanzee sympatry in southeastern Senegal: Impli-

cations for pathogen transmission and health.

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The ever increasing geographic overlap between human and nonhuman primates has important ecological, evolutionary and conservation implications. Intensification of contact between chimpanzees (*Pan troglodytes verus*) and burgeoning human populations in southeastern Senegal is resulting in an escalated risk of disease transmission. Our ability to mitigate these potentially deadly results depends on a clear understanding of both population health and behavior. This study, conducted May-August 2005, addresses the overlap and potential risks of disease transmission of the Fongoli community of chimpanzees and three sympatric human communities. More than 50 interviews with permanent residents in this area suggest that although they do not eat chimpanzees, their lack of sanitary waste management and consumption of water contaminated with coliform places both populations at risk of pathogen transmission. Representative biological samples of both populations were collected and analyzed using non-invasive fecal flotation and sedimentation techniques. Prevalence of helminthes, protozoans, nematodes, cestodes, and trematodes were compared. The Fongoli communities parasitic prevalence are contrasted with a natural control group of chimpanzees that have minimal human contact. Cultural and biological implications of this study for the long term management of threatened primate populations are discussed. This study addresses the need for baseline data regarding primate health while determining current and potential risks to this vulnerable population.

Sex identification in the pelvis: A re-examination of base-wing measurements, sacral anterior curvature, and *os Pubis* ventral arc.

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Features of the *os pubis* and the sacrum have been identified for attribution of sex. Kimura (1982) used a base-wing index (B/WI) for sexing the sacrum and Bass (1987:108) identifies sacral anterior curvature as sex specific. Sutherland & Suchey (1991) evaluated the pubic ventral arc for sex determination. The present study re-examines these observations.

Pelves and sacra from 141 known American Whites and Blacks were selected from the Terry Collection. B/WI was derived following Kimura, although instead of measuring the right side of the wing this present study took the maximum breadth of the sacrum and divided by two to get an averaged wing measurement. Sacral anterior curvature depth recorded using a coordinate caliper, and ventral arc scoring followed Sutherland & Suchey.

B/WI values did not reflect Kimura's results. Although overall measurement values agreed in the Blacks, White males had a greater B-WI than females, produced by significantly different wing length from Kimura, which is surprising since Kimura also used the Terry Collection. The ventral arc is present in 100% of White females and 88.57% of Black females and not observed in any males. Sacral anterior curvature is not supported as a sex criterion by this study. The sacrum tends to be flatter in females, but the mean depth difference between sexes is only 2.23mm. Therefore, using the curvature of the sacrum alone cannot identify sex.

To address discrepancy between Kimura's results, and better assess sacral curvature for both sexes, data are presently being gathered from larger sample size.

Cranial non-metric variation within a medieval cemetery in Giecz, Poland.

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It has been suggested that non-metric (discrete) traits can be used to measure biological distance within skeletal populations. Discrete traits are thought to be genetically influenced, and not affected by physical activity or the environment. As such, it should be possible to detect cultural changes as reflected in patterns of cemetery arrangement, as well as the presence of genetic outliers within a skeletal population, using biodistance analysis. The medieval cemetery in Giecz, Poland, in use between the 11th and 12th centuries AD, provides an opportunity to apply biodistance analysis to detect major cultural change. In 1038 AD, the Czech Prince Brzetyslaw I captured the stronghold, and its associated village, thus leading to major religious, social and political upheaval in the region, and possibly an influx of individuals of Czech descent. These changes have biological consequences that should be reflected in the distribution of discontinuous traits within the cemetery at Giecz.

Statistical measures of biodistance were applied to the skeletal remains of adult individuals (20+ years of age) from the Giecz cemetery (N=67) in order to identify patterns in cemetery arrangement, as well as the presence of genetic outliers. Twenty-five cranial non-metric traits were selected, including at least one from each of the four types of non-metric traits (foramina variability, ossification failures, proliferative ossifications and ossicles). Results suggest that there are multiple subgroups present within the Giecz cemetery, and indicate the need for a larger study including Czech and Polish skeletal populations that are contemporaneous with the sample from Giecz.

Linguistic and genetic correspondence in native Central and South America.

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Geneticists propose that a process of population fissions, expansions into new territories, and isolation of ancestral and descendant groups will produce congruent language and gene trees. To evaluate this population fissions process, we collected published mtDNA sequences for 1450 individuals from 22 Native Central and South American populations. We then tested the hypothesis that several hierarchical language classifications also represented the genetic structure of these populations. Though we rejected the hypothesis for the complete language classifications, we identified linguistic and genetic correspondence in several shallow branches shared by each classification. We then evaluated a second "diffusion" mechanism of linguistic and genetic coevolution that predicts a decline in both genetic and linguistic distance between populations as the geographic distance between them increases. To evaluate this diffusion mechanism, we constructed matrices of population linguistic, mtDNA sequence, and geographic distances for the same 22 populations and measured the correlation between linguistic and genetic distances with and without controlling geographic distance. We found that linguistic and genetic distances were uncorrelated in the full sample, but were correlated in the western region of South America. As predicted by the diffusion process, this western region correlation disappeared when geographic distance was controlled. However because the magnitude of the correlation was weak, we conclude that various population processes have obscured or erased linguistic and genetic correspondences in Central and South America. We also conclude that such correspondences are more likely to form within subregions united by common geography, ecology and culture.

Swinging pendulum crops hominin bush.

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At mid-century human paleontologists confronted a luxuriant, species-rich hominin phylogenetic tree. Subsequently, a forceful coterie of Occamites adduced empirical and theoretical evidence to argue the hominin lineage was species-poor. The hominin phylogenetic tree has proven resilient in the face of such pruning, and new growth has replaced much of what was trimmed. Most paleontologists now advocate a speciose human ancestry, and a bushy paradigm has ascended to orthodoxy. Is this a permanent paradigm? Is it that a more sophisticated approach has made branches and twigs that always existed visible, or is the pendulum due to swing back? I examined the issue of speciosity among living primates. I attempted to craft an empirical prediction of hominin speciosity based on living primates. I gathered data on primate species numbers, body mass, brain size, habitat, ranging and canopy use. I utilized linear hierarchical modeling, multiple regression and other methods to determine influences on speciosity among living primates. Typical primate genera are species-poor. Of 65 nonhuman primate genera, 41 contain only one or two species. The median number of primate species per genus is two. Living and fossil large hominoids are particularly species-poor. Among primates, brain size, Nc (Extra Neurons), dryness of habitat, terrestriality, body weight and dimorphism were all negatively correlated with species numbers, and contributed to a multinomial model suggesting that a genus such as *Australopithecus* is expected to contain few species. Living primates offer no reason to expect the hominin lineage to be speciose.

3-D morphometrics of the human femur: Taxonomic and functional information from late Pleistocene Eurasia.

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Recent research is showing that postcranial skeletal variation is not a simple record of biomechanical loading history but may in fact be under strong genetic control. Three-dimensional geometric morphometrics (3DGM) are used to search for patterned variation in overall femoral shape. This is a novel approach that may help alleviate problems plaguing character-based taxonomic assessments of this and other skeletal elements. Earlier studies have shown 3DGM of the femur provide discriminant taxonomic power at the generic level within the Hominidae.

It is assumed that adult whole bone form is at least to some degree genetically defined. Patterns of variation that are common between taxa and which show low levels of within- and between-group variance might be interpreted as baseline minima for structural and systemic integrity for hominin bipedality as a whole. Patterns that show low within-taxon variability but high between-taxa variability are likely the result of genetic differences. Patterns that show high within- and between-group variability are almost certainly phenotypically plastic are likely more useful for inferring behaviour.

This study tests the hypothesis that the femur is too plastic to have low-level taxonomic utility using the femora of Neandertals, late Pleistocene and Holocene humans from Eurasia. Digitized data points underwent Procrustes transformation and Principal Components Analysis (PCA). PCA of the digital femoral data clearly distinguishes between Neandertal and anatomically modern humans (AMH). Patterns of variability within and between groups can identify more salient morphological markers of taxonomic and functional differences.

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The evolutionary significance of canine reduction in hominins: Functional links between jaw mechanics and canine size.

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There is no consensus as to the functional significance of canine length reduction in hominins (Plavcan, 2001). In this paper we describe functional links between canine length and jaw mechanics in catarrhines. We then hypothesize a proximate explanation for canine reduction in hominins.

Following an analysis of maximum jaw gape in primates (Hylander and Vinyard, nd), we find that relative to total mandibular length, adult male nonhuman catarrhines have much larger gape than do females. Furthermore, there are considerable interspecific differences in the amount of relative gape. For example, long-tailed, lion-tailed and pig-tailed macaques have much larger gape than do rhesus and Japanese macaques. Moreover, chimpanzees have less relative gape than do cercopithecines, but more so than humans. Furthermore, coupled with data reported by Plavcan (1990), catarrhines with relatively smaller gape have relatively shorter canines.

Relative maximum gape is a function of jaw adductor muscle-fiber length and muscle position, and there are important costs and benefits linked to modifying these muscle characteristics. More caudally positioned muscles and/or longer muscle fibers have the benefit of increasing jaw gape, but the cost is a reduction in converting adductor muscle force into bite force. Conversely, more rostrally positioned muscles and/or shorter muscle fibers increase bite force, but at the cost of reducing maximum gape. We suggest that in the earliest hominins, selection pressures for increased bite force exceeded those pressures for maintaining large gape (and large canines). Thus, canine reduction was a necessary functional outcome to minimize canine interference associated with decreased gape.

Revisiting Neanderthal mitochondrial DNA sequence variation.

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In the debate on modern human origins, the question of the relationship between modern humans and Neanderthals is controversial. Previous studies have reported four unique Neanderthal hypervariable region I mtDNA sequences greater than 300 base pairs. These previous studies and others of Neanderthal sequence variation suggest that the divergence date of the Neanderthal lineage from that of modern humans ranges from 317,000 to 853,000 years ago. Phylogenetic analyses are mixed in their support for a species separation of modern humans and Neanderthals.

I used the same four sequences along with 247 from modern humans and 40 from chimpanzees to recalculate the human-Neanderthal population divergence date and construct a gene tree of the 291 sequences. Since an initial test rejected a molecular clock, I modified the method of Ingman and Gyllensten (2001) for removal of homoplasic and highly variable sites, and reduced the site list. Using this reduced site list, clock-like behavior could not be rejected. The reduced data yielded a UPGMA tree that supports the phylogenetic separation of modern humans and Neanderthals. Moreover, these populations have been separate for 1.25 million years.

Taphonomy and site formation of the 20m Solo River Terrace, Java Indonesia: implications for Late Pleistocene *H. erectus*.

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Three Indonesian sites (Ngandong, Jigar and Sambungmacan) have yielded late Pleistocene radiometric ages, two of the three also contain fossil hominins, suggesting the existence of a late surviving population of Javanese *H. erectus*. However, a number of questions surround site formation processes and, therefore, the association between the hominins and these ages. Both Ngandong and Jigar occupy the 20 meter terrace of the Solo River, yield similar ages, and appear to represent similar site formation processes. Here we present preliminary taphonomic evaluation of faunal assemblages from Jigar in order to assess site formation in the 20m terrace.

The Jigar faunal assemblage consists of 187 bone and tooth fragments excavated in the late 1970s. Over 70% of the assemblage is large mammal (size class three or larger), including elephant, bovid (*Bibos* and *Bubalus*), and cervid, as well as turtle. Elements in the assemblage exhibit fairly uniform taphonomic signatures. Bones show little evidence for weathering, indicating a short pre-burial surface exposure of the assemblage. None of the specimens had any evidence of sedimentary abrasion marks and little rounding of their edges is evident. Taken together, this suggests that although the assemblage is water-lain, fluvial transport did not have a major effect on assemblage composition, nor on individual bone specimens. Such a conclusion makes it less likely that the site was formed by the amalgamation of deposits of vastly different ages.

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The place of Jebel Moya in northeast African prehistory: A dental perspective.

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Between 1911-1914 the Wellcome Expedition recovered >3,000 human skeletons (ca. 3,000-100 BC) and an abundance of artifacts from the site of Jebel Moya in central Sudan. This material was anticipated to yield a wealth of information on the ancient inhabitants of this largely unexplored region of Africa. Unfortunately, the project was beset with problems, including: osteological errors in recording, poor stratigraphic control, and the expedition leader's death with a resulting delay of the site report. However, the worst was yet to come when authors of the longer-delayed physical anthropology report discovered that <4% of the skeletons survived storage in WWII-era London to allow study. Still, the report (Mukherjee et al., 1955), using the Mahalanobis D^2 statistic on craniometric data for the first time, ascertained that Jebel Moya was intermediate to, yet distinct from, 19 other North and sub-Saharan African samples.

Recent reappraisals of the archaeological evidence and new age estimates prompted the author to reevaluate the skeletal remains relative to the same or similar African samples in the original study. However, in the present case dental morphological variants were used for comparison. Inter-sample affinities using the Mahalanobis D^2 for discrete traits also reveal an intermediate-but-distinct pattern like the craniometric findings, albeit with a closer North African affiliation. This, together with previous findings, including heterogeneous mortuary practices, is consistent with Gerharz' (1994) claim that these nomadic herders represented an amalgamation of ethnic groups, whose common identity was simply maintained by their periodic cohabitation of Jebel Moya.

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Leaner diet, less energy: Diademed sifakas (*Propithecus diadema*) in forest fragments show reduced ranging and altered activity patterns.

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Forest fragmentation is thought to threaten primate populations, yet the mechanisms by which this occurs remain largely unknown. I present results from a 12-month study of the ranging and activity of *Propithecus diadema* at Tsinjoarivo, eastern Madagascar, including two groups in small fragments and two groups in nearby continuous forest. CONT groups had higher dietary diversity and ate more fleshy fruit. During winter, dietary diversity dropped and they relied heavily on the small mistletoe *Bakerella* (diameter < 2 m). In contrast, FRAG groups relied on mistletoes year-round; the fruits that sustain CONT groups throughout the summer are absent. I tested the hypothesis that the highly altered resource base would affect FRAG groups' ranging and activity patterns. Minimum convex polygon home ranges (excluding non-forested areas) are small in FRAG groups (25-35 ha) relative to CONT groups (50-60 ha); similar patterns were seen in kernel home ranges. Day range varied seasonally in both habitats (longer in the summer) but was shorter in fragments. Activity patterns are prolonged in fragments, with groups tending to arrive at sleep trees later. Activity budgets are surprisingly similar when broad categories (feed, rest, travel, social) are considered, though FRAG groups do feed more and CONT groups travel more. Grooming times are also remarkably similar. However, play (a higher-energy social activity) was strikingly less common in fragments. These results suggest that FRAG groups are energetically stressed, a finding consistent with their lower average body mass.

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Differences in hand and foot morphology of eastern gorilla subspecies.

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Ecological contrasts between eastern gorilla populations provide a valuable opportunity to assess adaptive variation in postcranial skeletal morphology within a modern ape species, with implications for the functional and taxonomic interpretation of variation in fossil hominoids. Mountain gorillas (*Gorilla beringei beringei*) live at high altitudes. As fruit trees are absent, their diet relies on terrestrial vegetation. Eastern lowland gorillas (*G.b. graueri*) live at lower elevations where fruit trees grow. Their more frugivorous diet necessitates more arboreal behavior and also more travel between feeding sites. These differences lead to the prediction that *G.b. graueri* hands and feet will exhibit greater expression of features related to climbing and features related to knuckle-walking, in comparison with mountain gorillas.

A set of 42 linear measurements was collected from hand and foot bones of *G.b. beringei* (n=21) and *G.b. graueri* (n=25). Univariate comparisons demonstrate significant differences between the subspecies in a number of functionally-relevant indices, including both those related to knuckle-walking and those related to climbing. Results are largely consistent across both sexes. Multivariate analyses show strong separation between the subspecies, using either hands or feet. Since Groves' (1970) recognition of differing hallux-to-foot-length proportions, this is the first study to identify differences in hand and foot bones between *G.b. beringei* and *G.b. graueri*.

The suite of morphological differences between the hands and feet of eastern gorilla subspecies appears to reflect adaptations to local environmental conditions, suggesting that many features of fossil hominoid postcranial morphology may closely track habitat, even in phylogenetically and geographically proximate populations.

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Contexts of positional behavior in captive pygmy marmosets (*Cebuella pygmaea*).

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Pygmy marmosets are well known for their distinctive adaptation to gummivory, and they have been reported to exhibit high frequencies of claw clinging to vertical supports in association with this dietary specialization. However, there has been little detailed study of their positional behavioral repertoire and activity budgets beyond the field work of Youlatos (1999) and current work by Garber on specifics of their leaping behavior in captivity.

This study reports the results of 80 hours of observation of a pair of captive pygmy marmosets. Details of their positional behavior, support size and structure, associated behavioral contexts, and whether or not they were vocalizing or engaged in agonistic interactions were recorded. The animals were housed with two other primate species, *Leontopithecus chrysomelas* and *Pithecia pithecia*.

The two marmosets did not differ significantly in most locomotor behaviors; they did differ significantly in frequencies of many postures. Only further study will indicate if these are sex-related or simply individual differences. They shared a strong preference for medium supports (76.5% at 6-10 cm) and for oblique (54.3%) and horizontal (40.2%) supports. Claw clinging accounted for 79% of time spent on vertical supports. Vertical leaping was rare. Vocalizations and agonistic behaviors were seldom seen.

When compared to results on wild pygmy marmosets. Major differences relate to the unavailability of opportunities for gummivory and scarcity of both terminal supports and insect foods in captivity. Captive pygmy marmosets spend far more time resting (76.7% either laying or sitting) than do those in the wild.

Overnight sodium excretion differentiates awake-sleep blood pressure variation between African-American and European-American women.

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A blunted decline in waking to sleep blood pressure (BP) (non-dipping) has been shown to predict cardiovascular morbidity in women. Several studies also show that African-Americans (AA) in general, are more prone to non-dipping than European-Americans (EA), contributing to AA women's greater cardiovascular morbidity risk. It has been suggested that possible biologic/genetic differences in renal sodium handling may contribute to this ethnic difference in BP variation; however, few ethnic comparative studies of waking and sleeping sodium handling have been conducted. The purpose of this study was to compare the daily rates of urinary sodium, potassium and aldosterone excretion in AA (N=34) and EA (N=53) women cross-classified by non-dipping (N=53))/dipping (N=34) BP status. The women (AA, age= 33.5$\pm$ 8.1, EA, age=35.2$\pm$9.4) collected timed urine samples at work (11-3 PM), home (approx. 6-10 PM) and during sleep (approx. 10PM-6AM), which were assayed for sodium, potassium and aldosterone. Using ANCOVA techniques, the results showed that AA had greater sodium ($p<.015$), lower potassium ($p<.007$) and lower aldosterone (.026) excretion rates than EA at work during the day, but that these differences were not related to BP non-dipping. However, overnight, AA BP non-dippers excreted 55% more sodium ($p<.048$) and 60% more aldosterone ($p<.05$) than AA BP dippers, while EA BP non-dippers did not differ from their BP dipping counterparts. These results may suggest that the non-dipping mechanism in AA is different than that in EA, and that non-dipping in AA is related to altered sodium handling during sleep.

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Injury and treatment of the pectoral girdle in two medieval populations.

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Based on archaeological evidence, it has been suggested that the Dominican house of the Blackfriars, Gloucester, may have served in part as a form of infirmary. To test this claim, individuals from Blackfriars were compared to individuals from St. James and St. Mary Magdalene, Chichester, a known medieval hospital. Macroscopic and radiographic analysis of pectoral girdle trauma was undertaken in an attempt to ascertain relative levels of care between the two communities. Fractures of the clavicle, humerus and scapula as well as dislocations of the acromioclavicular and glenohumeral joints were recorded. Other forms of trauma, including acromioclavicular and glenohumeral degenerative joint disease, rotator cuff impingement and avascular necrosis, were included in the analysis.

In Chichester, the males appear to have led a more hazardous lifestyle, resulting in more fractures, than the females. Conversely, in Blackfriars there exists far more females with traumas than males. This suggests that the elderly and infirm, as well as children, may have been sheltered in the institution by the male friars. However, little evidence has been found which substantiates the suggestion that the friars provided actual medical treatment at Blackfriars.

Comparison of Dmanisi hominid pectoral girdle and upper limb morphology.

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New pectoral girdle and upper limb elements were recovered from Dmanisi during the 2001-2005 excavation season. These remains significantly increase the hominid post-cranial sample from Dmanisi and, more broadly, for lower Pleistocene hominids. This study is based on measurements from this sample, which includes one scapula, three clavicles, and three humeri. Comparisons were made with modern humans, African great apes, and fossil hominid specimens.

Our results indicate that the scapula share characters with both extant and fossil humans as well as apes. Among the traits displayed by these specimens are a small glenoid index, a somewhat cranially oriented glenoid cavity, narrow spino-trapezium and gleno-coracoid angles.

Regarding the humeri, several of the indices studied (capitular length and width, height of the lateral epicondyle vs. the capitular height) are out of the range of variation of modern humans and similar with African great apes. The distal end measurements are similar with *Homo habilis* and *Homo erectus* (excluding biepicondylar dimensions). The articular dimensions show a mixed pattern of similarities and differences relative to australopithecines.

The dimensions of the clavicles are in the lower part of the range variation of modern humans and comparable to KNM-WT 15000 and OH 8.

According to the morphometrical, morphological and stratigraphic contexts we suggest that these remains belong to two different individuals (adult and adolescent) and could be associated with the D2700 and D3444 skulls. The results of this investigation suggest that the Dmanisi post-cranial fossils are similar to early *Homo*, with minor similarities with extant African apes.

Osteological remains from Salango, Ecuador with comparisons to other Ecuadorian coastal sites.

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Archaeological site 035 located in Salango, Ecuador contains remains associated with the Manteño culture, which flourished during the Integration period from A.D. 500 until the Spanish Conquest in 1532. Although agriculture played a role in the diet of these people, marine resources were utilized for both food and trade. Osteological remains of 14 individuals were excavated from the Salango site and examined to determine variation in the population of this region. Two sites, Ayalán, an Integration site containing 435 individuals, and La Tolita, a Formative period site containing 18 individuals, were used for comparison based upon similar environmental conditions. In addition, Real Alto south of Salango with 51 individuals and La Libertad with 24 individuals were used for comparisons to coastal sites with environments that were drier than that found at Salango. The Salango site contains a wide range of ages of both sexes with fetal, newborn, juvenile, subadult, adult and elderly remains present. Preliminary data indicate that the Salango population possesses fewer pathologies than the comparison sites. The few pathologies identified include cribra orbitalia on two individuals, one case of non-specific infection and one or two cases of osteoarthritis. The rate of infection at the Salango site when compared to other regional sites is surprising considering that the others are coastal marine sites with populations that appear to have engaged in similar activities. This study indicates that pre-Colombian cultures of the region may not have been entirely integrated and that the various populations may have engaged in varied lifestyles.

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Mitochondrial capture in the evolution of baboon and human allotaxa.

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Extant *Papio* baboons live as geographically replacing, phenotypically and (often) behaviorally distinct taxa, which interbreed where they meet, forming hybrid zones of varying width. Such allotaxa are considered species by some systematists, and subspecies or semispecies by others, and have been suggested as possible analogs to contemporaneous human populations whose status is similarly contentious. Authorities on both sides of the "Neandertal debate" apparently agree that evidence for significant genetic communication across the boundary between the forms would argue for conspecificity, while long-term persistence of distinct phenotypes suggests genetic isolation, and hence species rank for each. Others have argued that this distinction is simplistic, and that natural selection might disperse favored genes across a semi-permeable boundary, even as the lineages remain phenotypically distinct. Our group's findings in baboons support the latter view. Specifically, some baboon populations belong phenotypically to one taxon, but are allied mitochondrially with another. As in other organisms as varied as crickets and elephants, "mitochondrial capture", driven by massive, asymmetrical, male dispersal, probably explains such discordances. One major form of baboon (*Papio anubis*) has yet to be associated with any unique mitochondrial clade, and is tentatively identified as a stabilized hybrid. In this respect, baboon allotaxa are clearly quite different from Neandertals and "modern" humans, in which evidence for mitochondrial admixture and capture is conspicuously absent.

Biomechanical stress markers in a historic population from the Central Coast of California: An analysis of Dove Cemetery, Atascadero, California.

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The remains of seventeen individuals, consisting of ten males, three females, and four juveniles, were exhumed from a mid to late nineteenth century cemetery in Atascadero, California. During this period of time, the area associated with the cemetery was predominantly a farming community with at least one nearby rancho in operation. Indicators of biomechanical stress, attributed to heavy labor and repetitive movement, were present in the postcranial remains of approximately 84% of the adults at this site. Approximately 54% of the adults present exhibited at least one axial lesion while approximately 77% exhibited at least one appendicular lesion.

These lesions fit within four, general, categories: proliferative bone growth, degenerative joint disease, loading and ambulatory responses, and traumatic injuries. Furthermore, though apparent differences in sexual division of labor were observed, limiting factors attributed to the female population—such as inadequate sample size, poor preservation, and relatively younger age ranges—are more likely the reason for such bias. As such, male and female populations were combined. In addition, juvenile individuals, exhibiting no pathological lesions, were excluded from the analyzed sample.

Though age and genetics are possible factors in several of these conditions, degenerative changes in younger adults, as well as the overall skeletal pattern of pathological lesions, indicate that biomechanical stress is also a likely factor. The prevalence and patterning of specific lesions indicate that multiple individuals at Dove Cemetery performed similar, culturally patterned, behaviors consistent with those expected in an agriculturally based community.

Investigating intra skeletal stable isotope variation.

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Stable isotope analyses of archaeological human bone samples are routinely used for reconstructing the dietary history of individuals or populations. This project focuses on intra skeletal variability of the stable isotopic compositions ($\delta^{13}C$ and $\delta^{15}N$) of human bone collagen. Previous studies on intra skeletal variability within single skeletons have been based on limited sample sizes and it has not always been possible to be consistent in the selection of skeletal elements.

This study comprises 73 well preserved skeletons of both adults and juveniles from a medieval cemetery in Denmark. Sampling strategy was based on the well documented archaeological and historical records indicating that these individuals were a homogeneous population, consuming a similar diet throughout their lives. From each individual a sample from the femoral diaphysis and rib were selected, and furthermore a sample of the petrous part of the temporal bone was taken from 59 of the individuals.

Our results show that the petrous bone has an isotopic signal that differs significantly from both femur and rib values within the single skeleton. Conversely, only minor variation was found between femur and rib.

The intra skeletal variations may reflect differences in turnover rates among the skeletal elements, with the petrous bone usually being regarded as having a very low turnover rate (and formed early in life), whereas the rib and femur have a higher turnover rate.

Our results may have consequences for sampling strategy in future projects concerning dietary reconstruction.

Self sacrifice or slaughter? The mass burials of Kerma.

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Kerma's (1750-1550 BC) royal cemetery in Upper Nubia featured tumuli bisected by mass inhumation corridors and a central royal burial chamber. Traditionally, the corridor burials are attributed to sac-

rifices of retainers or prisoners. Surrounding smaller tumuli are associated with the Kerma elite. No previous bioarchaeological investigation has confirmed either assumption.

Our study revealed a comparable trauma profile for both 'corridor' and 'non-corridor' samples, with no perimortem trauma among the 'corridor' sample to suggest a violent death. The injury pattern observed did not indicate that one group was more susceptible than the other to physical abuse. That is, although more frequent and intense skull injuries occurred among the 'corridor' sample, the 'non-corridor' people were more likely to suffer from parry fractures, other long bone fractures and multiple injuries.

Descriptive, univariate and multivariate comparisons of 13 cranial measurements (Collett, 1933) in the two samples (n=253), by sex, suggest phenetic similarity. Specifically, the coefficient of variation did not find the 'corridor' measurements to vary more than the 'non-corridor' – as might be expected if the former comprised a mixture of foreign slaves and prisoners. Similarly, t-tests revealed that none of the 13 measurements differed significantly. Discriminant analysis produced correct between-sample classification rates only slightly better than random assignment.

Ethnic Nubian burial features and artifacts did not suggest a predominant foreign- or status-related element in either context. In sum, we found nothing to suggest that the 'corridor' and 'non-corridor' samples derived from different populations; both appear to have been biologically and culturally Kerman.

TB in pre-contact North America: Who had it and what was it.

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We have demonstrated the presence of a novel species of prehistoric Mycobacterium tuberculosis complex (MTC) existing in a precontact Native American population from Illinois (*M. hrdlickae sp. nov.*). Here we address questions as to its origin and distribution, both temporal and spatial, through phylogenetic analysis of multiple loci and broad sampling of several populations of the Eastern Woodlands region. We will discuss the implications for the evolution of the MTC on the North American continent in light of these results.

How do environmental and historical effects shape primate communities?

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Researchers often examine the factors shaping community structure from an ecological or historical context. Environmental characteristics shape the possible niches in a community, providing suitable habitats to some species and not others. Therefore, communities exhibiting similar environmental characteristics are more likely to display a more similar species composition. Additionally, as the geographic distance between communities increases, dispersal between sites is more limited and the probability of historical vicariance increases. Therefore, communities in close proximity to each other are likely to display a similar composition of species. The objective of this study was to simultaneously examine the relative effects of environmental and historical effects on primate communities in the Neotropics, Asia, Africa and Madagascar. Data for over 70 primate communities were gathered from the published literature. Partial Mantel tests were conducted to examine the relative effects of geographic distance and environmental similarity on community structure. The analyses showed that in the Neotropics and Asia there was a significant negative correlation between geographic distance and community similarity when controlling for environmental similarity. There was no environmental effect for these continents. In contrast, in Africa and Madagascar, there was a significant positive relationship between environmental similarity and community similarity while holding geographic distance constant. There was no effect of geographic distance in these regions. These results will be discussed in the context of the evolutionary and geologic history of primates and their areas of endemism.

Bone density and bone mineral content in premenopausal monkeys are affected by social status but not by high isoflavone soy protein.

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We investigated the potential bone-sparing effects of soy in female monkeys with a study designed to address two questions: 1) does chronic exposure to soy protein and isoflavones enhance premenopausal bone mineral content and density (surrogate markers for future fracture risk)? And 2) is low social status (a condition often associated with suppressed reproductive hormones and elevated cortisol) a premenopausal determinant of reduced bone mineral content/density?
Ninety-sex skeletally mature, premenopausal cynomolgus monkeys (*Macaca fascicularis*) were assigned to consume a diet that derived its source of protein from either casein-lactalbumin, or from soy protein containing 1.88 mg total isoflavones/g protein (equivalent to a human intake of approximately 129 mg/day). Whole body bone mineral content (WBBMC) and lumbar vertebrae (2-4) bone mineral density (LVBMD) were determined at baseline and following 12 and 24 months of diet treatment. Bone biomarkers were evaluated at baseline and at 24 months. Social status was determined weekly.

There were no significant differences between casein and soy fed monkeys in WBBMC or LVBMD. However, WBBMC and LVBMD were significantly lower in subordinate relative to dominant monkeys at baseline, an effect that persisted throughout the study. Bone specific alkaline phosphatase was inversely associated with both social status and WBBMC, but was unaffected by diet treatment.
We conclude that high isoflavone soy protein does not alter premenopausal markers of fracture risk. In contrast, low social status depresses bone mineral content and density, an effect that may reflect the relative estrogen deficiency and hypercortisolemia that usually accompany this behavioral condition.

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Historical peopling of the New World: Y chromosome roots.

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The early peopling of Americas is a topic of intense interest in numerous scientific fields. Although a large number of studies from diverse disciplines have explored this question, a consensus still has not been achieved. Unsolved problems include the timing of earliest migration(s) to American continents, the number of migrations, the geographic location of the founding Asian population(s), and the nature of the evolutionary processes that shaped patterns of Native American genetic variation.

This paper reviews Y chromosome data from the Americas and Asia in the context of the early peopling of the Americas. Different modes of colonization based on archaeological, demographic, and linguistic data, as well as from computer simulations, were considered to examine what scenario might be supported by Y chromosome data from contemporary populations. We compared genetic diversity of three major Native American paternal founding lineages with similar parameters from Asian populations. The correlations among paternal genetics, language, and geography were examined to investigate patterns of association in Siberia and the

Americas. To investigate the possibility of clinal distributions for Siberian and Native American Y chromosomes we conducted spatial autocorrelation analyses on the data from Americas and Asia. We attempted to identify the most probable geographic source for Native American Y chromosomes with phylogenetic analyses of STR (short tandem repeats) variation. Estimated times of divergence for major Y chromosome lineages between the Native American and Asian populations were used to make inferences on the number and timing of migrations.

Multi-modal analysis of an aye-aye brain combining histology, structural MRI, and diffusion-tensor imaging (DTI).

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The aye-aye (*Daubentonia madagascariensis*) is the most highly-encephalized of the Strepsirhini, and occupies a unique ecological niche that includes percussive extractive foraging. We scanned the left hemisphere of an aye-aye brain using T2-weighted structural magnetic resonance imaging (MRI) and diffusion-tensor imaging (DTI) prior to histological processing and staining for Nissl substance and myelinated fibers. The objectives of our experiment were to estimate the volume of gross brain regions for comparison with published data on other prosimians, and to validate DTI data on fiber anisotropy with histological measurements of fiber spread. Measurements of brain structure volumes in our specimen are consistent with those reported in the literature: the aye-aye has a very large brain for its body size, it has a reduced volume of visual structures (V1 and LGN), and an increased volume of the olfactory lobe. This trade-off between visual and olfactory reliance is a reflection of the nocturnal extractive foraging behavior practiced by *Daubentonia*. Additionally, frontal cortex volume is large in the aye-aye, a feature that could also be related to its complex foraging behavior and increased sensorimotor intelligence. Our analysis of white matter fiber structure in the anterior cingulum bundle demonstrates a strong correlation between fiber spread as measured from histological sections and fiber spread as measured from DTI. These results represent the first quantitative comparison of DTI data and fiber-stained histology in the brain.

Paranasal pneumatization in the early Miocene platyrrhine *Homunculus patagonicus*.

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Homunculus patagonicus, an early Miocene (~16 Ma) fossil platyrrhine from Patagonian Argentina, is known from several new cranial specimens discovered by a joint Argentine and Duke University team at several sites north of Rio Gallegos in coastal Santa Cruz Province, Argentina. The remarkable preservation of one specimen from Killik Aike Norte allows a rare opportunity to explore internal cranial anatomy in a well-preserved, undistorted context. Among extant platyrrhines, paranasal pneumatization is present in most taxa, in the form of the maxillary sinus, but is lacking in a few species (Rossie, J., DOI: 10.1002/jmor.10263). This distribution suggests that the presence of a maxillary sinus is primitive for crown platyrrhines, as for anthropoids as a whole. To explore the internal cranial anatomy, microCT scans were made in the coronal plane at the University of Texas CT scanning facility.

The preservation of delicate internal structures is impressive; some ethmoturbinals are visible. *Homunculus* has no paranasal pneumatization other than maxillary sinuses. The latter are present above the molars and extend laterally past the zygomatico-maxillary suture into the zygomatic bone. The ostia are found bilaterally above M1. The floor of the sinus is below that of the nasal cavity anteriorly, and the molar roots extend into the sinus space. Preliminary analyses of estimated sinus volume (approx. 0.5 cc) in *Homunculus* conforms to a platyrrhine sinus/size regression that is approximately isometric. This is similar to the situation in hominoids, suggesting that maxillary sinus volume is highly conserved in anthropoid evolution.

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Morphology of the last lumbar vertebra in four orthograde primates: defining facet and pedicle orientation using three-dimensional vectors

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Recent morphological studies of the primate spine indicate that last lumbar posterior element morphology may reflect postural and locomotor behavior. However, the loads to which they are subjected are unestablished and the role of the pedicle in force transmission has not been defined. A simplified static free body model, based upon biomechanical techniques, demonstrated that facet and pedicle orientations are necessary for the development of a more sophisticated model in which forces on last lumbar posterior elements are calculated. Using three-dimensional coordinates and matrix algebra, facet and pedicle center points were determined and their orientations were calculated for four orthograde species, *Gorilla gorilla, Homo sapiens, Pan troglodytes,* and *Pongo pygmaeus.* The statistical analysis indicated that these vectors are very consistent within species, suggesting that they can be used for the future development of a biomechanical model. Pair-wise tests were also conducted using the *Gorilla gorilla, Homo sapiens*, and *Pan troglodytes. Pongo pygmaeus* was excluded due to sample size. These tests demonstrated that the species have statistically different mean directions. Within species consistency of vector orientation, combined with the pair-wise results, may support the hypothesis that posterior element morphology reflects postural and locomotor behavior.

The status of lemur species at Antserananomby: An update.

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Antserananomby is a site in western Madagascar that is comprised of xerophytic and deciduous *Tamarindus* forests. Since RWS researched this site in 1970, Antserananomby has been cited in the literature as one of only a few remaining forests left within Madagascar's western region where primates can be found in unusually high densities.

In August 2004, we revisited Antserananomby to conduct a survey of the diurnal primates in the area. We found that although satellite images taken in 2000 indicated that the forests were intact, the 10 hectares known as Antserananomby Forest have since been cleared, the surrounding forests are regularly burned, and the lemurs are hunted. In addition, results of the primate survey found that the population densities of *Eulemur fulvus rufus* and *Lemur catta* have declined appreciably. On two different days, these two species were observed traveling as a mixed species group within the fragmented gallery forests. Conversely, *Propithecus verreauxi verreauxi* appears to be thriving, and it seems that there have been no local extinctions of primate species in the area. Of the nocturnal primates previously documented by RWS, all except

Cheirogaleous medius were identified (*i.e. Lepilemur ruficaudatus, Microcebus murinus, Mirza coquereli,* and *Phaner furcifer pallescens*).

We conclude that although much of the fauna previously recorded by RWS were observed during this survey, the current rate of deforestation at Antserananomby is unsustainable. If no action is taken to conserve what is left and restore what has been lost, then the forests and its inhabitants are likely to soon disappear.

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Timing of the peopling of the Americas: genetic analysis early Holocene skeletal remains.

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Previous mitochondrial DNA (mtDNA) studies suggest that human occupation of the Americas occurred 15,000-40,000 years ago, which pre-dates widely accepted archaeological evidence. These studies, however, rest on assumptions about the genetic composition of the founding population(s) and rates of molecular evolution. We evaluated these assumptions with DNA extracted from human remains dating to 10,300 cal yrs BP excavated from On Your Knees Cave on Prince of Wales Island, Alaska (site 49-PET-408). The mtDNA of this individual represents an additional founder lineage of haplogroup D in the Americas and is related to only ~1.4% of present-day Native Americans. Using 10,300 yrs BP as the minimum age of this lineage and an estimate of the level of phylogenetic dispersion (ρ) within descendant lineages, we show that previous calibrations of the mtDNA clock have underestimated the rate of molecular evolution by 2-4 times and, thus, overestimated the timing of the peopling of the Americas. Furthermore, Y-chromosome DNA extracted from the sample confirms that the skeletal remains are from a male. This individual's Y-chromosome belongs to haplogroup Q-M3*, placing a minimum date for the emergence of this haplogroup.

Sexual dimorphism in the bony birth canal of *Papio* and its relationships to true body mass, skeletal size, and cortical area of the femoral midshaft.

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Many sexually dimorphic primate species have a pelvis with dimensions related to the female bony birth canal that are disproportionately large when compared to other skeletal measures of body size. Within these species, the reverse is true in other skeletal measurements. Pelvic dimorphism has been attributed to factors such as obstetrics, phylogeny, and hormones. Body mass can correlate with bony birth canal size, other skeletal measurements, and vice versa. Therefore, differences in body mass should reveal differences in bony birth canal size within each sex.

This study uses the Bramblett savanna baboon collection, a skeletal collection of wild adult *Papio cynocephalus* (n=30) with associated body mass (taken at time of death). Body mass is compared with measurements of the pelvis, femur, and clavicle. This study contributes to the few studies testing correlations of true body mass with pelvic size. The hypothesis is strengthened while offering a different perspective. As expected, larger femora, larger clavicles, and some larger pelvic measurements coincide with greater body masses. However in pelvic measurements traditionally deemed to be related to obstetrics, gradients are separated by sex differences. Larger birth canals tend to occur with larger females compared to smaller females, and females have relatively larger bony birth canals than males, regardless of body mass. Since primate skeletal collections with actual body mass associations are rare, high resolution X-ray CT scans of the femoral midshaft (n=17) are analyzed to test a measure of cortical bone area as a potential proxy for true body mass within this taxon.

Postcranial metric variation in three Archaic period samples from western Tennessee.

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Variations in cranial dimensions have been extensively studied as a means of determining affinity or dissimilarity among prehistoric samples from the Americas (i.e., Jantz and Owsley 2001, 2004; Pucciarelli et al. 2003, Schillaci and Stojanowski 2002). Postcranial variation has rarely been used in such studies, perhaps because of the possible complications introduced by changes in mobility, subsistence strategy, health status (Larsen 1997), and climatic adaptation (Newman 1962). This project seeks to examine patterns of postcranial variation among three geographically proximate prehorticultural groups, which are selected in order to reduce the potential effects of the above complicating factors.

Ninety-seven individuals from three Archaic sites in western Tennessee, Cherry (84BN74, N=35), Ledbetter (9BN25, N=38), and Eva (6BN12, N=24) are examined for patterns of postcranial variation in length, epiphyseal size, and diameter. In total, thirty measurements taken on six elements are examined for intrapopulation and interpopulation variation. Patterns of sexual dimorphism and potential allometric relationships among various dimensions are considered. Comparable patterns of variance among the three sites indicate that these samples are derived from affiliated populations.

Isotopic approaches to paleoecological reconstruction at Olduvai Bed I (Tanzania) and Kanjera (Kenya).

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The late Pliocene represents a critical period in hominin evolution, with a series of speciation events suggesting an adaptive radiation in the hominin lineage between 3 and 2 Ma. Adaptive scenarios ultimately need to be assessed within the dynamic framework of specific, local ecological parameters. Fossil vertebrate fauna associated with the archeological and hominin fossil records arguably represent the most important archive of early hominin ecology. Here we utilize istotopic analyses of fossil herbivore tooth enamel to develop high resolution reconstructions of paleohabitats. The goal is to provide comparative ecological data in which to interpret hominin activities at Kanjera and Olduvai Gorge Bed I. The dietary preferences of a suite of fossil ungulate taxa are reconstructed through stable isotopic analysis of enamel to infer ecological characteristics of the habitats. Isotopic analysis of teeth and pedogenic carbonates are suggestive of different environmental settings for the activities of early *Homo* at Bed I Olduvai Gorge and

Kanjera. The Oldowan site complex at Kanjera was formed in a wooded grassland to open grassland, with the ungulate fauna dominated by C_4 grazing taxa. In contrast, Oldowan site assemblages at Bed I Olduvai were formed in open woodlands, and are associated with fauna more evenly spread across the C_3 – C_4 dietary spectrum. Habitat reconstructions at Olduvai and Kanjera (using isotopic and ecomorphic analyses) suggest significant heterogeneity in overall paleoenvironmental setting as well as in the specific habitats archeological sites were forming in, indicating that Oldowan hominins were utilizing a broad spectrum of the available settings.

Use of JC virus sequence data to provide independent estimates of population genetic parameters.

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JC virus (JCV) has been identified as a useful, effectively vertically, and possibly maternally, transmitted haploid genetic marker for inferring human population history (Holmes 2004; Pavesi 2005). Previous research has revealed significant discrepancies in the reconstructed worldwide demographic history and basal branching patterns of JCV relative to mtDNA and Y chromosome sequence data (Cann et al 1987; Wooding 2001; Underhill et al 2001; Sugimoto et al 2002), contradicting a global history of JCV and human co-divergence and co-demography. The goal of this research is to determine if JCV and human demography are correlated within regional populations and, if so, use JCV data to provide independent estimates of population genetic parameters important for the reconstruction of demographic history.

We assembled a dataset of 237 previously published coding region JCV DNA sequences (~4850bps). We calculated estimates of N_e and time to most recent common ancestor (TMRCA) for established regional populations (European, African, Asian and AfroAsian) using a Bayesian coalescent method and investigated historical trends in N_e using the Bayesian skyline plot method (Drummond et al 2005) as implemented in the BEAST v1.0 coalescent analysis program (Drummond & Rambaut 2003). Preliminary data show that TMRCA and N_e estimates for all African JCV sequences are much greater than those for European sequences (~2.25 and ~2.5 times greater, respectively), consistent with greater age and diversity of JCV in Africa. These results suggest that JCV data may be able to provide estimates of human population genetic parameters that are independent of human genomic systems.

Maternal and Paternal lineages of African Americans.

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African Americans have a unique population history. The population was originally formed by the forced transport of millions of indigenous Africans during the transatlantic slave trade from the early 1600s to the mid-1800s. While the vast majority of contemporary African Americans are descendants of enslaved Africans, most African Americans know little about their specific African ancestry. There have been few comprehensive studies that explore the genetic ancestry of African descent populations in the Americas. This is mainly because there has been a lack of genetic data from west and central African populations which were the source of the enslaved Africans. Until recently, large geographic gaps existed in genetic samples from Africa, leading to poorly defined areas (i.e., Angola, Gabon, Congo, and Zaire) where limited sampling of indigenous African populations occurred. The accumulation of genetic data comprising lineage-defining markers such as mtDNA and the Y-chromosome from indigenous west and central African populations has sparked major interest in the use of DNA-based tests for African ancestry. I will discuss critical issues related to the construction of the African Lineage Database (ALD), levels of genetic diversity across the African continent, and the broad range of responses from the African American community to DNA testing for ancestry.

Functional morphology of new *Dryopithecus* carpals from Rudabánya, Hungary

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The functional morphology of a right scaphoid and capitate from the late Miocene site of Rudabánya, Hungary are described. The body of the scaphoid (RUD 202) is largely complete but the tubercle is broken at the waist. RUD 167 is a nearly complete capitate of comparable overall size to the RUD 202. Linear and surface area measurements of carpal size and facet morphology are compared to extant non-human hominoids, four cercopithecoids and *Proconsul*, *Sivapithecus* and *Oreopithecus*. Multivariate analyses reveal that RUD 202 clusters more strongly with *Hylobates* and *Pongo* and to a lesser extent with *Gorilla*. RUD 167 clusters most strongly with *Pongo* and is in close proximity to *Proconsul* and *Gorilla*. The interpreted positional behavior of RUD 167 and RUD 202, based on the functional morphology of non-metric characters, is broadly consistent with these results in suggesting a more generalized, suspensory ape morphology. The weaker association with *Gorilla* and *Proconsul* may reflect a phylogenetic signal or a unique aspect of the positional behavior. RUD 167 and 202 are consistent in size with specimens attributed to *Dryopithecus*.

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Ossuary taphonomy: patterns and significance of commingled human remains at the colonial Chapel of San Pedro de Mórrope, Lambayeque Valley, Peru.

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Complex secondary burials and ossuaries are often treated as specialized mortuary contexts and an understanding of their formation and composition can open unique windows on population biology and burial ritual. We demonstrate this as we test the hypothesis that the ossuaries at the colonial chapel of San Pedro de Mórrope on the north coast of Peru represent straightforward exhumation and reburial, known from Old and New World churches alike in the effort to make space for new interments.

We integrate multiple lines of data from eight ossuaries, including stratigraphy, distribution of skeleton elements, bone breakage, forensic entomology, skeletal health, and demography (including MNI and the seriation of sexually dimorphic features and multiple cranial, dental, and pelvic age indicators).

MNI ranged from at least three to 74 individuals. Non-random distribution of skeletal elements strongly favors crania and long bones. These burials likely do not reflect a theoretically representative population, skewed in favor of adult males and children lacking signs of morbidity, and adults exhibiting advanced degenerative joint lesions in the arms and wrists. Examples of perimortem bone breakage accompanied by insect activity suggest some exhumed individuals were not fully decomposed and were exposed for 30 days or more.

We reject the hypothesis, and argue these ossuaries demonstrate hybrid Colonial mortuary rituals based on pre-Hispanic fertility rites involving intentional reburial of select individuals. Synthesizing taphonomic, archaeological, and bioarchaeological data can thus shed light on both population biology and the encoded meanings embodied in mortuary practices, contributing to a biocultural reconstruction of the past.

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PIMA (portable infrared mineral analyzer) as a quick and non-destructive tool for forensic anthropology.

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The portable infrared mineral analyzer (PIMA) uses short wave infrared harmonics of bending and stretching modes of molecular bonds to elucidate crystalline and compositional variations in several materials. Originally designed for field mineral analysis, it has proven useful in analysis of archaeological ceramics. Here we report its application to biomaterials from forensic scenes and sites. Surface spectra are quickly taken by placing the object flush with the window lens roughly the size of a contact lens.

Bone has a distinctive twin peak in the area of 1700 nm. that is the result of collagen, not apatite. The spectrum of Knox gelatin is nearly identical to that of bone, whereas the spectra of geologic apatites differ significantly. Because burning reduces collagen, the spectrum can distinguish sun-bleached from calcined bone, as well as a stained from a charred surface. The collagen peaks can remain in unburned bone for centuries. Tooth enamel has very reduced collagen peaks, compared to bone.

Hair also exhibits strong collagen peaks, which may distinguish it from look-alike insulating materials. Fingernails and turtle shell (really bone) also show the collagen twin peaks. The collagen twin peaks can distinguish many biomaterials from skillfully made casts, wigs, or other materials.

Genetic admixture, phenotype, and perception of admixture in Hispanics and Native Americans in New Mexico.

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Examining admixed populations is useful for disease mapping, characterizing inter-population differences, and for exploring interactions between genetic admixture and various personal, social, and phenotypic outcomes such as BMI, % body fat, skin pigmentation, and facial features. This study considers a population of Hispanics and Native Americans from the state of New Mexico. A panel of AIMs (Ancestry Informative Markers) is used to classify individuals along the European-Native American ancestry spectrum. Measurements of skin pigmentation, height, weight, % body fat as well as facial photographs are obtained from each individual. In addition, various data on self-identified ethnicity, self-perceived admixture proportions, social environment, and familial history is obtained. Relationships between genetic ancestry and self-perceived ancestry/ethnicity are examined as well as the perception of others' degree of shared ancestry as judged from facial photographs where both respondent and photographed individuals have known degrees of genetic admixture. Results generally show that genetic admixture is a moderately good predictor of a variety of traits, and that these are influenced by social and cultural factors. Implications concerning human evolutionary ecology and human diversity are discussed.

The life history of an Inka sacrifice using archaeological chemistry.

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In the Inka Empire, an important ritual practice involved sacrificing children to the *apus*, or regional deities, located in provinces across the empire. Despite an abundance of archaeological and ethnohistorical data on the *capacocha* and related rituals, many questions surround the identity of these children. Spanish accounts relate that children from the provinces came to the capital in Cuzco before then traveling to the region where they would be sacrificed. Where were these children from? Were they chosen from local populations near their site of sacrifice? Or were they brought in from distant regions under Inka control?

Here we combine archaeological chemistry and bioarchaeology to investigate the life history of an individual buried in an Inka dedicatory sacrifice in front of the Pumapunku pyramid at Tiwanaku as an apparent *capacocha* offering. Strontium and oxygen isotope analysis of dental and skeletal elements that formed at different times over this individual's life show movement between different geologic and environmental zones. More specifically, while the strontium isotope signatures ($^{87}Sr/^{86}Sr$) in three tooth enamel and two bone samples are within the Lake Titicaca Basin signatures, the variability in the isotope signatures implies movement within the Basin or a geologic zone with a similar strontium isotope signature. However, oxygen isotope analysis of the same dental and skeletal elements show that the oxygen isotope ratios ($\delta^{18}O_{sc}$) are lower than measured oxygen isotope ratios in groundwater and archaeological human remains from the Basin; these data imply that this individual spent time at a lower altitude and is not in fact from the Lake Titicaca Basin.

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Population structure analysis from prehistoric skeletal material.

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As a result of the advent of aDNA studies, morphological analyses of prehistoric skeletal material are viewed by some as relatively pedestrian and uninformative. The analysis of bones and teeth themselves (as opposed to the DNA contained within them), however, still has an important place within physical anthropology because: 1) preservation, political, and other issues may preclude the extraction of aDNA, 2) sample sizes for aDNA analyses are typically quite limited when compared to sample sizes for morphological analyses, and 3) the number of independent loci sampled in aDNA studies is typically quite small. What aDNA studies do provide, aside from a known genetic system, is a framework for assessing past studies of population structure made from skeletal morphology. In this sense, there is nothing particularly unique to aDNA studies, as they are typically founded on the coalescent model, the same type of model (genetic drift) on which past studies of population structure are founded. Where the two types of analyses (aDNA and morphological) diverge is in terms of appropriate analytical methods, with some researchers being misled into thinking that mismatch and intermatch distributions are an appropriate tool for analyzing discrete skeletal morphology. To show the proper role of morphometric analyses, we re-analyze nonmetric cranial discrete traits from prehistoric West Central Illinois skeletal material (N = 1,082), which Konigsberg (1990) previously analyzed within an isolation by distance model. Our reanalysis makes use of more recent developments that allow for estimation of F_{st}, thus setting the context for the following symposium.

Metric and non-metric variation in the clavicle of the Monongahela.

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This is part of a larger study of skeletal variation in Monongahelans from Campbell's Farm, California, PA (1050-1100 CE). The Monongahela were horticulturalists, whose staple crop was maize

(Johnson, et al. 1989). This study investigates whether clavicular metric and non-metric variation reflects occupational stress and/or male/female division of labor. Metric variants included: mesiolateral length, anteroposterior widths of inner/outer ends, minimum width, anteroposterior width at conoid tubercle, height of inner end, circumference, thickness index, and indices of inner/outer ends. Non-metric variants included rhomboid fossae and articular facets on the conoid tubercle.

Bilateral asymmetry was significant in width of inner end ($p=0.006$, $n=14$), minimum width ($p=0.008$, $n=23$), width at conoid tubercle ($p=0.013$, $n=24$), and index of outer end ($p=0.029$, $n=14$). Significant sex differences were found in length ($p=0.004$, $n=9$), width of outer end ($p=0.059$, $n=7$), and circumference ($p=0.012$, $n=10$). Rhomboid fossae were found in 91.7% of right ($n=24$) and 88.5% of left ($n=26$) clavicles. Articular facets on the conoid tubercle were present in 16.7% of right ($n=24$) and 4.3% of left ($n=23$) clavicles. Non-metric variation did not differ significantly with sex ($p>0.05$); however, an articular facet was more frequent on the right clavicle ($p<0.05$). Occupational stress and sexual dimorphism may account for significance of data with regard, respectively, to asymmetry and sex. Non-sex-correlated variations, excluding length, width of outer end, and circumference, may indicate similar male/female activity. These data will be part of a larger examination of occupational stress and division of labor among Monongahelans.

A preliminary study of troop leadership during travel in black and gold howler monkeys.

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Sex-biased behaviors are common in non-human primates. They involve differential resource and risk allocations as functions of their anticipated reproductive output. Greater direct female investment in reproduction implies that females should influence travel decisions affecting foraging efficiency more than males. We explored evidence of sex-biased differences in both travel progression and the initiation of group movement in *Alouatta caraya*.

Data were compared across three activities, feeding, resting, and encounters with neighboring groups. Group leadership was defined by the sex of the individual initiating and ending progression. Two groups of *A. caraya* were followed 5 days a month from May to November 2004 on Isla Brasilera (27º 20' S and 58º 40' W) in northern Argentina. We recorded 319 displacements and registered who was leading the progression and the number of changes in leadership during feeding, resting and intergroup-encounters. Considering all behavioral contexts together, there were no significant differences in the sex that led movement ($X^2=0.2$,$df=1$,$p>0.05$). Females led movement to feeding sites and resting sites more often than did males, and males led movement to intergroup encounters more often than females ($G=17.2$, $df=2$,$p<0.05$). There were no significant differences between the number of false starts and the sex of the initiator ($G=0.48$,$df=1$,$p>0.05$).

Females may benefit from leading movement to feeding sites if this enables them to increase access to food resources. Males played an important role in leading the group during inter-encounter groups that related to territorial and group cooperative defense. Additional relationships between troop leadership and howler behavioral ecology are discussed.

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Social influence on the development of foraging in Aye-Ayes (*Daubentonia madagascariensis*) and Ruffed Lemurs (*Varecia variegata rubra*).

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Species with complex foraging behaviors may require extensive skill learning, particularly social learning, to develop adult-level competency. Uniquely among prosimians, aye-ayes display tap-foraging behavior, a coordinated series of tapping, gnawing, and extraction of wood-boring larvae. Krakauer (2005) reported that immature aye-ayes rely on social learning, including food sharing and peering, to develop tap-foraging skills. In this study I explored whether other lemur species rely on the same degree of social learning as aye-ayes during foraging development. I compared aye-aye foraging development to that of a similar-sized prosimian, the ruffed lemur, which is a straightforward frugivore. Behavioral and experimental data were collected at the Duke University Primate Center, Durham, NC, USA, and the Durrell Wildlife Conservation Trust, Jersey, Channel Islands, on immature aye-aye ($n=4$) and ruffed lemur ($n=4$) foraging development and novel food avoidance. Results show that the onset of aye-aye foraging is markedly delayed relative to ruffed lemurs. Aye-ayes co-fed with, shared food with, and peered at, mothers significantly more than ruffed lemurs, and demonstrated greater neophobia towards novel foods. Additionally, only aye-aye mothers were found to be tolerant of food-motivated offspring. Overall, aye-ayes engaged in behaviors that are conducive to social learning significantly more than ruffed lemurs. This interspecific contrast helps to identify a broad suite of features in species that require extensive skill learning during development. Furthermore, social learning appears to be a critical component of skilled development, thus providing skilled foragers with a capacity for culture.

Anatomical incongruity of the glenohumeral joint in primates.

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The anatomical incongruity of the glenohumeral joint surface areas were determined through direct surface area measurements by using an optical three-dimensional digitizer in cooperation with the Fraunhofer Institute for Applied Optics and Precision Engineering (IOF) in Jena, Germany. The left humerus and scapula of up to now 145 specimen belonging to 42 mammalian genera were examined.

Preliminary data of glenohumeral surface areas show that it is possible to differentiate between quadrupedal and suspensory locomotion by means of the degree of incongruity. The latter type of locomotion may be initial for the high mobility of the glenohumeral joint which is proofed for genera like Hylobates and Symphalangus (Hylobatidae). To which extent the differences within quadrupeds are due to locomotion type, different load levelling or body size needs to be examined carefully.

Cineradiographic studies on mammalian locomotion including quadrupedal primates showed that the mobility of the glenohumeral joint cannot solely be explained by locomotion but is probably determined by other forms of motion like grooming, feeding, reaching, etc., which in this context will be called “idiomotion”. We assume that the degree of mobility is intimately connected with this non-locomotive behaviour. Direct examination of these idiomotional parameters in connection with anatomical structures are not available for such a diverse group of mammals. So a comparative study of the mobility of the shoulder joint needs to be made within and between primates and other mammals to find out if there are any convergent findings or similarities in mechanisms for compensation of disturbance.

Biomechanics of the mandible: Results from experimental impact testing.

A.M. Kroman, T.A. Kress, S.A. Symes

The geometry of the mandible makes investigation of its biomechanical properties a complex subject. Previous research has focused on everything from cross sectional geometry, internal architecture, and the application of beam theory. In this study we used geometry and engineering analysis to predict fracture location and patterns. 15 human mandibles from fresh fully fleshed cadaver heads were impacted during the testing. Five were impacted in the mental region, five in the body of the mandible, and five in the region of the gonial angle. All testing was conducted using an engineering drop tower system. Load cells in the drop tower impactor allowed for monitoring of force through out the event, and recorded the peak force at which failure occurred. All of the mandibles were fitted with strain gauges, which measured the changes in stress and strain of different regions of the mandible during the impact event. After impact, the mandibles were processed and the fracture patterns examined and charted. The biomechanical response of the mandible to external force is more complex than simple beam theory dictates, due to intrinsic factors and the complicated geometry and the constraints imposed by adjacent bony structures, primarily the interface with the temporomandibular joint. As expected, the biomechanics of mandible fractures can be characterized by the direction of force, magnitude of force, and geometry of the impact area. Experimental results were consistent with the engineering analysis for prediction of fracture location.

Anterior dental microwear of the prehistoric Point Hope communities.

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The prehistoric coastal communities of Point Hope, Alaska have been considered important Arctic archaeological sites since their initial excavations in 1939. The majority of the archaeological artifacts are grouped into two temporally distinct cultural components, the Ipiutak (2100-1500BP) and the Tigara (800-300BP). Although debated, Arctic archaeologists have suggested that the Ipiutak depended heavily on land mammals with only seasonal reliance on sea mammals, whereas the Tigara relied primarily on sea mammals including whales. While both groups clearly utilized foraging subsistence economies, the contrasts in their food acquisition strategies would have placed different demands on the males and females, particularly with regard to paramasticatory behavior. This paper addresses aspects of the gender-based division of labor in the Ipiutak and Tigara through an analysis of their patterns of anterior dental microwear.

Human dental remains of 100 individuals from the Point Hope collection curated at the American Museum of Natural History were sampled. Sex determination was made using standard osteological techniques. Dental molds and casts were produced for 25 males and 25 females each for both the Ipiutak and the Tigara samples. Qualitative composite images of the dental microwear defects have been created in order to highlight dental surface features such as pits, scratches, and polish.

Preliminary results indicate distinctive differences in the patterns of occlusal surface defects between the male and female dentitions from Point Hope. Additionally, female Ipiutak incisors show a higher incidence of surface defects when compared to their Tigara counterparts suggesting a greater frequency of more demanding paramasticatory activities.

Value of micro-computed tomography versus light microscopy analysis for human historic bone samples.

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A common way to examine historic bone pathologies is the use of conventional X-ray and computed tomography (CT). Yet, both methods are not able to visualize the microarchitecture of the bone, which provides the most information in terms of pathological alterations. Until now only histological methods could provide such insights. Micro-CT (µCT) is a relatively new non-invasive method for high resolution 3D visualization of bone (Feldkamp et al., 1989; Rüegsegger et al., 1996). Surprisingly, the literature database Medline® contains e.g., no single publication about the visualization of osteomyelitis, syphilis, Paget's disease or tuberculosis by means of µCT. We present the first ever application of µCT in the assessment of bone architecture in a vast range of historic bone pathology samples (Rühli et al., 2005).

Bone fragments from an early 20th century AD human pathology reference series (Galler collection, Institute for the History of Medicine University of Zurich / Natural History Museum Basel Switzerland; Rühli et al., 2003) have been examined by µCT (µCT 40 Scanco Medical) and by light microscopy.

The application of µCT – despite its restrictions in terms of maximal sample size and its lack of information on collagen alignment - has enhanced the understanding of the qualitative alterations of 3D bone architecture caused by various underlying pathologies such as tuberculosis or syphilis. Also, the bony microarchitecture appears completely different at localizations of only a few millimeters distance. Thus, µCT makes it much easier to find the critical structures in the whole 3D volume of a particular specimen.

So early hominids grew up like apes -- now what?

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This paper reviews recent research concerning life history evolution in early hominids in an attempt to reconcile available evidence for early hominid growth and development with predictions of life history theory. When questions about early hominid life history were first raised, debate centered on whether early hominids were characterized by a 'human-like' prolonged period of growth and development, which was cited as a prerequisite for key 'human' cultural and cognitive behaviors. It is now recognized that the australopithecines and early members of the genus *Homo* grew up 'like apes' with shorter periods of growth and development compared to modern humans. Generally, this finding fits the predictions primate and hominid life history models, since at least some early hominids were small-brained & small-bodied. Likewise, *Paranthropus* is characterized by shorter periods of dental (and presumably somatic) development compared to *Australopithecus*, conforming to life history predictions for species subsisting on low-quality diets.

Other findings do not as neatly fit expectations based on life history models. While some species of early *Homo* were at least moderately larger-brained and larger-bodied than the australopithecines, analyses suggest that a significantly prolonged dental (or somatic) developmental period only evolved in Neanderthals and modern humans. Crown formation times in these taxa are in fact shorter, and dental emergence times earlier, than life history models would predict from brain size alone. This suggests that multiple factors are 'driving' life history evolution, and that some have constrained the effect of increased brain size on early hominid life history.

Life history perspectives on growth, productivity and adult physiology and function.

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Comparative mammalian studies reveal that, much like metabolic rate, inter-

specific variation in growth rate and offspring birth size scale tightly with adult body mass. These relationships suggest deeply-conserved connections between body size and metabolism that constrain allocation to growth and reproduction. Inter-specific models of mammalian life history assume a continuity across the life cycle in excess metabolic capacity, or productivity: during the growing years, a portion of productivity is devoted to building the body, and after the cessation of growth, a similar metabolic fraction is devoted to reproductive expenditures. This framework may help shed light on the now widely-described relationships between early life nutrition and growth and later function and physiology in adulthood. However, given that the complex developmental stages of the human lifecycle are characterized by different growth velocities, it is not clear at what stage growth rate should most tightly correlate with adult functional or reproductive outcomes. Moreover, given this human pattern, what are the long-term implications of developmental plasticity, such as growth faltering or catch-up growth? This paper will explore the links between growth and adult function, and propose a model linking growth rate plasticity with population variation in adult reproductive function and sexual dimorphism.

Methods and sources for an informed approach to the identification, quantification, and interpretation of violent trauma in the bioarchaeological record.

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Reports of injuries attributable to violence are common in the bioarchaeological literature, and such injuries form the primary corpus of data for an increasing number of biocultural studies. Sometimes lagging behind this growing scholarly interest in osteological evidence of violence, however, is an informed approach to the interpretation of these data in terms of injury/victim frequencies in death assemblages and the living populations from which they derive, impacts of violence on different sectors of society, and both proximate and ultimate causation. The data needed to construct such an interpretive framework are in many cases not available from the existing bioarchaeological literature, but rather, must be gleaned from alternative sources. These include: ethnographic, historic, and archaeological sources; historic and modern medical reports; state and federal census reports; and other government studies and publications (e.g., statistics on hunting accidents). The purpose of this paper is to expand on work by Lambert (1994, 1997) and Milner (2005) that explores how data from these "ancillary" sources can be used to: 1) "flesh out" behaviors surroundings the infliction of wounds recorded in bone; 2) more accurately identify and quantify wound and victim frequencies, thereby permitting better assessment of population-level impacts of violence; and 3) better contextualize these data within a broader theoretical framework of violence and warfare causation models, as well as other models that invoke violence and warfare as causal factors in social change.

Saltatory growth biology, dynamic systems and selection.

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At the level of the whole body, a growth process characterized by intermittent saltatory spurts permits complex networks of deterministic and stochastic components to be integrated as the body undergoes growth, differentiation and aging. A saltatory event is an outcome of endogenous signals coupled to physiological responses as the organism interacts with the environment. Variability in the timing and amount of growth at each saltatory event permits maximum flexibility in a diversity of ecologies.

Longitudinal studies employing a growth event perspective, in which growth data are collected in parallel with biobehavioral data, identify a sequence of behaviors that nonrandomly predict growth saltations. These data generate hypotheses regarding candidate hormones that may drive or contribute to a cascade of signals involved in the timing and amount of unique growth saltations.

Developing techniques to test these hypotheses in the laboratory is proving successful and is beginning to define outlines of growth cascade biology. Aspects of this cascade identify growth as a time of risk. Restricting growth to discrete temporal events is an adaptive strategy and provides for a wide range of potential developmental pathways. A pulsatile system that reflects the integration of multi-nodal signals permits an interplay between the genome and the environment. By modifying its own pathway in terms of variable pulsatile growth patterns, such a dynamic system provides a mechanism by which reproductive maturation can be attained in a diversity of environmental conditions.

Functions of male care of infants in siamangs *(Symphalangus syndactylus).*

S. Lappan. Department of Anthropology, San Diego State University.

Siamangs are unusual among the gibbons in that they display extensive male care of infants in the wild and in captivity. However, while previous studies of wild siamangs have noted extensive male involvement in infant care during the second year of life, patterns of infant care among wild siamangs have not been documented in detail, and the function of male care in siamangs remains poorly understood. In this study, I collected behavioral data from five wild siamang groups at the Way Canguk Research Station in southern Sumatra from shortly after the birth of an infant to age 15-24 months to test hypotheses about the function of male care in siamangs.

Male care may function as a form of parental investment by improving infant survivorship or quality. Alternatively, male care may function as a form of courtship. Finally, male care may function as a form of investment in female fertility, reducing the energetic burden on females and shortening inter-birth intervals. Each of these hypotheses generates predictions that could be directly or indirectly tested using available data. As these hypotheses are not mutually exclusive, male care may also have multiple functions. The results of this study were not consistent with the courtship hypotheses, while results of tests of the parental investment hypothesis were mixed. The results of this study consistently supported the hypothesis that male care functions as an investment in female fertility.

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Health and disease in the Ipiutak and Tigara of Point Hope, Alaska.

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Arctic foragers have long attracted anthropological interest for both their unique cultural patterns and their occupation of extreme cold environments. Researchers have noted that the demands of these polar lifeways most likely presented greater health risks to these groups, especially for prehistoric peoples. In order to assess the relative patterns of environmental and culturally induced stress as well as the associated biological response in such human groups, this study analyzes postcranial pathological lesions in two adult skeletal samples of pre-contact Arctic foragers from Point Hope, Alaska.

The Ipiutak (2100-1500BP) and Tigara (800-300BP) archaeological sites are situated along the Chukchi Sea approximately 150 miles above the Arctic Circle. The Ipiutak presumably relied seasonally on both land and sea mammals while the Tigara relied predominately on sea mammals. Each subsistence strategy placed

unique economic and physiological demands on adult males and females.

We examined the skeletons of 45 Ipiutak (25 males; 20 females) and 147 Tigara individuals (81 males; 66 females) for postcranial evidence of fractures and infectious lesions. Pathological lesion types and frequencies were noted as well as their postcranial location. Results indicate a dramatic increase in the types and incidence of lesions for both male and female Tigara with the shift towards an increased reliance on whale hunting when compared to the non-whaling Ipiutak. Additionally, the Tigara exhibit a greater range of lesions indicative of infections and infectious diseases. This analysis contributes additional information towards understanding the range and variability of health and disease associated with foraging economies.

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Distributions of newly defined Y-chromosome haplogroups K6 and K7 in Island Melanesia.

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Comparisons of human genetic variation in the mitochondrial DNA (mtDNA) and in the non-recombining portion of the Y chromosome (NRY) often have tended to show distinct differences. Within Island Melanesia, the mtDNA haplogroups show considerable island-by-island distinctions and geographic constraint, and have considerable antiquity dating to 50,000-40,000 BP. Previous studies of the NRY did not detect similar variation or age. Several demographic interpretations have been put forth to explain this distinction. However, this apparent disparity may simply be the result of a bias in the ascertainment of genetic variation in the non-recombining portion of the notoriously invariant Y chromosome versus the mtDNA, which is highly variable, especially in the control region.

The identification of several new NRY single nucleotide polymorphisms (SNPs) have added increased differentiation to the macrohaplogroup K in Island Melanesia, and have shown that NRY variation in Island Melanesia is approximately equivalent with mtDNA diversity. These analyses may overcome the ascertainment of bias associated with NRY variation in this region of the world by showing clear differentiations between the islands of New Guinea, New Ireland, New Britain, and Bougainville, as had been previously shown in the mtDNA results. The new SNPs are K6 and K7, with K7 being mostly restricted to New Britain.

Conservation biology of Verreaux's sifaka (*Propithecus verreauxi verreauxi*): Prospective and retrospective perturbation analyses.

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In this study, we employ two separate analyses in order to understand how population growth rate (*pgr*) responds to changes in the population's *vital rates* (rates of survival, growth, and fertility). Prospective analyses are commonly used to inform management decisions and ask the question: how would *pgr* change, given a change in one or more of the vital rates? Retrospective analyses examine how variation in *pgr* is expressed a function of the (co)variation of the vital rates. These analyses reveal how variation in growth, survival, and fertility contributes to variation in *pgr*. Our prospective analysis was achieved by developing a time-invariant, five-stage matrix model using 17 years of data collected on a wild population of Verreaux's sifaka. Using this matrix model, we calculated sensitivity and elasticity values that capture the prospective dependency of how *pgr* would change, given a change in a vital rate. Our retrospective analysis draws from matrix models developed from the first half and last half of the 17-year dataset. From these matrices, we decompose temporal variation in *pgr* into contributions from the temporal variation in the vital rates. Our results show that *pgr* is most sensitive to transitions into maternity, and less dependent on survival and growth of reproductively immature animals. We also find that variation in survivorship of mothers contributes the largest amount to variation in *pgr*. Our results suggest that the long-term viability of the sifaka population depends on recruitment of females into motherhood and is less dependent on the survival of pre-reproductive females.

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A comparative genomics approach to primate craniofacial evolution.

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Changes in primate craniofacial size and shape are well documented, providing much information on both the tempo and the mode of hominid evolution. However, until the fundamental molecular factors underlying these changes are understood, knowledge of hominid skull evolution is limited. This project addresses the molecular/ morphological interface under a comparative genomics framework by focusing on coding sequences experimentally demonstrated to affect craniofacial development, both early and later patterning, as well as suture morphogenesis.

To date, 26 orthologous craniofacial gene trios have been extracted and aligned from the human (*Homo sapiens*), chimpanzee (*Pan troglodytes*) and macaque (*Macaca mulatta*) whole-genome assemblies. Preliminary analyses of the ratio of non-synonymous to synonymous substitutions (K_A/K_S) among these trios reveal that most of these sequences do not violate the neutral hypothesis of molecular evolution (n=24). Yet the fossil record indicates the skull has undergone relatively recent and rapid change in the hominid lineage. Because a single amino acid change can have dramatic effects on the encoded product, and hence phenotypic trait, the molecular position and biochemical natures of the amino acid substitutions in all 26 genes are being examined to consider structural, and potentially functional, changes in product. Results of these analyses will be used to investigate overall *patterns* of change among these three species. Future research will include analyses of expression differences in these genes among these species.

A new approach to dental sexual dimorphism in the Krapina Neandertals.

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Sexual dimorphism is an important component of morphological variation, and has been extensively studied in association with other variables related to socioecology, adaptation, phylogeny, and behavior. The most frequently used measurement of sexual dimorphism in size is a ratio between male and female averages; direct comparisons have been limited using this measurement because it does not have a sampling distribution. This paper proposes that the mean of ratios be used instead of the ratio of means. This new way of quantifying sexual dimorphism is useful as it is associated with a variance, which allows statistical comparisons between populations or species. Using a data resampling approach, the new quantification of sexual dimorphism can be estimated for samples of unknown sex.

The question of whether sexual dimorphism decreased or was in stasis throughout the evolutionary history of the genus *Homo* is examined. Dental materials from

Krapina are analyzed to test the hypothesis of no change between Krapina and other hominid dental samples of earlier and later periods: Sima de los Huesos, Zhoukoudian, and Předmostí. The results show the null hypothesis cannot be rejected: i.e., there is no demonstrable difference among these samples. However, sampling error cannot be excluded as an explanation. It is concluded that we simply may not have enough data in fossil samples to examine sexual dimorphism with statistical rigor.

Genetic diversity in the Himalayas: Gm and Inv markers in some Nepali and Tibetan populations.

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We report in this study the polymorphisms of the Gm and Km markers of the immunoglobulins in different casts or ethnic groups of Nepal population sampled in Kathmandu and Kali Gandaki valleys, and Tibetans settled in the refugee camps of Jawalakhel (Kathmandu) and Tashi Ling (Pokhara). These samples have been tested for eleven (11) Gm allotypes and two (2)à Km ones. The resulting Gm phenotypes can be explained by nine (9) haplotype combinations. The haplotypes reveals in Nepal a large admixture of 'caucasoïd' and 'mongoloïd' genes of populations related to different geographical localizations following their gene frequencies and genetic comparisons with Asian neihbours. Tibetans appear more homogenous surely because most of individuals of the sample belong to the Drog Pa, a pastoral large tribe of west Tibet. A clear genetic structure is displayed in this part of the Himalayas.

Fitness and canine size in male mandrills (*Mandrillus sphinx*).

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Interspecific comparative analyses show that primate canine tooth size dimorphism covaries with intermale competition. However, relations between male fitness and canine size have not been demonstrated at the population level. We test the hypothesis that canine size covaries with male reproductive output in mandrills, the most dimorphic primate species.

Data from 61 semi-free-ranging male mandrills, including canine length and somatometrics, were matched with paternity data based on microsatellite loci. Fisher's reproductive value and number of offspring sired are estimated, along with a rate-sensitive measure of individual fitness (lambda). Status (alpha vs. nonalpha) is also analyzed.

Only 16 of the males in this population sired. Canine size precisely matches reproductive output, increasing as the tooth erupts and declining in the last 1/3 of the lifespan as the tooth wears. Both variables are maximized between 10 and 12 years of age. Sires have significantly larger canines than nonsires, but body dimensions do not differ according to reproductive status. Alphas have significantly higher fitness than nonalpha sires, but not larger canines. A postreproductive period is observed among the oldest males.

Canine tooth length largely determines the schedule of reproduction in mandrills, with the intensity of sexual selection maximized during the brief window of peak canine size. Big canines increase the likelihood of siring offspring. The tight correlation between canine size and reproduction provides direct insights into life history parameters in fossils. We discuss the implications of these results for measures of selection.

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New hand bones of *Hadropithecus stenognathus*: implications for the paleobiology of the Archaeolemuridae.

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A partial and associated skeleton of *Hadropithecus stenognathus* (AHA-I) was discovered in 2003 at Andrahomana Cave in southeast Madagascar. Among the postcranial elements found were the first hand bones attributed to this rare subfossil lemur (right scaphoid, right hamate, left first metacarpal, and right and left fifth metacarpals). These elements were compared to those of (1) extant strepsirrhines and cercopithecoids to infer the positional adaptations of *Hadropithecus* and (2) *Archaeolemur* to assess similarities in hand morphology among archaeolemurids.

The scaphoid tubercle does not project palmarly as in suspensory and climbing taxa, and shows a facet for a sizeable prepollex. The hamate has no hook at all, which indicates a poorly developed carpal tunnel. There is a distinctive, mediolaterally directed "spiral" facet for articulation with the triquetrum that is similar to that of pronograde lemurs and Old World monkeys. The pollex is very reduced and represents only 48% of the length of metacarpal V, as in *Archaeolemur* and *Avahi*. Compared to *Archaeolemur*, the shaft of metacarpal V is more gracile and the head has no dorsal ridge. Proximally, the articular facet for the hamate is oriented more dorsally. Thus, the carpometacarpal joint V may have a distinctive "hyperextended" set that has no analogue among primates. The carpals of *Hadropithecus* are diagnostic of a pronograde, arboterrestrial locomotor repertoire without suspensory or climbing specializations. Although highly derived, the hand of *Hadropithecus* shares several similarities with that of its sister taxon *Archaeolemur*, including a very reduced pollex and an enigmatically large prepollex.

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***Mycobacterium tuberculosis* strains from the contact period in North America: Implications for the evolutionary history of TB.**

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The existence of tuberculosis in the New World prior to European contact has been confirmed with the identification of a 123 base pair (bp) segment of IS*6110*, an insertion sequence unique to species of the *Mycobacterium tuberculosis* Complex, in a 1000-year old Peruvian mummy. However, the strains present in the Peruvian remains have not been phylogenetically defined. This project uses silent single nucleotide polymorphisms (SNPs) to place ancient New World tuberculosis strains in a phylogenetic context. 200-300 year old skeletal remains from the Arikara, a North American Indian population that inhabited the Missouri River Valley, were tested for the presence of *M. tuberculosis* DNA. The remains were selected for skeletal indicators of miliary tuberculosis. A subset (n=7) yielded PCR product for the 123 bp IS*6110* fragment. In addition, two primer sets designed to amplify short (100-120 bp) segments of the *M. tuberculosis* genome yielded PCR products of the expected size. The PCR products were cloned and sequenced, and the SNPs within the regions of interest were used to construct a neighbor-joining tree that includes the ancient strains and modern clinical TB isolates. Our results indicate the North American strains are more closely related to the progenitor strain of the *M. tuberculosis* Complex than they are to *M. bovis*.

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Metabolic variation and adaptation to cold stress among indigenous circumpolar populations.

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Previous research has suggested that arctic populations have adapted to their cold, marginal environments through increased metabolic heat production. Recent studies of indigenous populations of the Siberia and North America have confirmed these findings, and have shed light on the physiological and genetic mechanisms through which northern populations adapt to their environments. This paper will examine patterns of variation in basal metabolic rate (BMR) in a sample of 177 men and 228 women from 5 indigenous circumpolar populations of North America and Siberia. Native populations of the north show significant elevations in BMR compared to reference values based on body weight and lean body mass. Contrary to earlier research, the elevated BMRs of indigenous circumpolar groups are not attributable to high dietary protein consumption. Although consumption of traditional high protein/high fat diets does appear to increase BMR by ~10%, northern populations consuming non-traditional "mixed" diets still show elevations in metabolic rate of about 15-20% above reference values. Short-term changes in thyroid hormone levels appear to play an important role in increasing metabolic rate during the cold winter months. Additionally, it appears that underlying genetic differences may regulate the influence of thyroid hormones on metabolic rate. We outline further research directions for elucidating the underlying mechanisms for metabolic adaptation among indigenous northern populations.

Computerized shape analysis of the Japanese mandible: Sexual dimorphism.

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Although size differences due to sexual dimorphism are well established, differences due to shape are not well documented in the craniofacial complex. The presence of sexual dimorphism in dental arch shape has been documented (AJODO 125:716-725, 2004). The mean female arch displays a longer and narrower arcade in contrast to males. Whether these differences are also reflected in the mandible (MD), was the subject of this investigation.

To address this issue, a new approach, *computational shape analysis* (CSA) was developed. It is based on a Fourier-wavelet representation, which is comprised of two aspects: [1] elliptical Fourier functions (EFFs), providing estimates of *global aspects,* and [2] continuous wavelet transforms (CWTs), generating objective estimates of *localized features*. Two MD samples were obtained, one from the Edo Period (1600-1868) (n=42 ♀; n =52 ♂) from the National Science Center in Tokyo, and the other, cadaver material (~1905) (n=32 ♀; n=29 ♂) from the Kyoto University Museum.

Each mandible was positioned with the inferior side facing the camera. Only specimens with relatively complete dentitions were utilized to minimize the effect of bone resorption due to tooth loss. The MD outlines were digitized with 90 points. Each MD was fitted with EFFs standardized for size. Both EFFs and CWTs independently detected differences in sexual dimorphism. The mean female MD is longer when compared with males. These results demonstrate that CSA based on global aspects and localized feature extraction, is a useful method for numerically characterizing complex irregularly-shaped forms of the type encountered in the biological sciences.

Scaling of human brain components.

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In recent years, there has been much discussion regarding the interspecific scaling of brain components and their relationship to overall brain size (e.g., Barton and Harvey, 2000; Finlay and Darlington, 1995). We have initiated a series of investigations to examine similar issues for intraspecific brain size in adult humans, and report here observations on the corpus callosum and cerebellum. As intraspecific correlation coefficients between brain size and brain components are relatively low (0.20 – 0.50), differences between reduced major axis (RMA) and least squares (LS) regression slopes are important. For three published datasets, RMA slopes of corpus callosum cross-sectional area against brain volume are: 0.846, 1.636 and 1.243. All three studies indicate positive scaling of relative corpus callosum size (given the expected slope of 0.66 for geometric similarity), but leave unresolved the question of area-volume isometry (an expected slope of 1.0). Thus, as brain size increases, the ratio of corpus callosum area to brain weight may become larger or smaller. For four published datasets, RMA slopes of cerebellum volume against brain volume are: 1.067, 1.141, 1.294 and 1.038, indicating some positive allometry in all cases. As brain size increases, the ratio of cerebellum volume to brain volume increases. RMA slopes for the cerebellum are more consistent among studies than for the corpus callosum. The large variation among results for the corpus callosum is atypical of other intraspecific morphometric datasets. This may be due to measurement error in defining the anatomical boundaries of the corpus callosum. Measurement error may be a significant limitation in evaluating human intraspecific brain allometry.

Native South American history examined by generalized hierarchical modeling.

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In this study, molecular genetic data are used to evaluate scenarios for the initial peopling of South America and to infer subsequent population histories. A generalized hierarchical modeling approach is applied to mean nucleotide gene diversity from mtDNA hypervariable region 1 sequences (n= 768) that represent 22 South American, 3 Central American and 3 North American populations. We evaluated 26 models representing different genetic relationships within and among populations and regions. In the process, we observed three major patterns. i) The diversity in South America is reduced from the total observed for North, Central, and South America. ii) Within South America, there are complex regional differences in the extent and pattern of diversity. In the east, the diversity within groups is low and the diversity among groups is high. In the west, the diversity within groups is moderate, and the diversity among groups is low. iii) When the model permits this complex patterning, we find that the eastern region harbors the entirety of diversity on the South American continent, whereas the western region harbors only a portion of the continental diversity. A single migration into South America followed by regional differentiation is most parsimonious explanation of the nested pattern of diversity. We hypothesize that more frequent fissions, extinctions, and bottlenecks characterize the structure of eastern populations, while an expansion of a single group characterizes the western populations.

Biological indicators of hunter-gatherer adaptation and cultural

change in the mid-Holocene Cis-Baikal.

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This investigation of the Cis-Baikal skeletal and dental record focuses on health and lifestyle reconstruction of the region's mid-Holocene foragers with particular interest in the circumstances surrounding an alleged fifth millennium BC biocultural hiatus (Weber 1995, Weber *et al.* 2002). The five cemetery populations considered – two representing the pre-hiatus Kitoi culture and three the post-hiatus Serovo-Glaskovo – provide an excellent opportunity not only to characterize boreal forest foraging adaptation, but also to investigate cultural change in the region. Research focuses on three discrete lines of bioarchaeological inquiry: dental enamel hypoplasia, osteoarthritis, and paleopathology (both skeletal and dental). Results reveal several discrepancies between the pre- and post-hiatus peoples, lending some support to previous assertions of distinct Kitoi and Serovo-Glaskovo adaptive regimes, particularly the narrower subsistence base and lower residential mobility of the former. For example, pre-hiatus individuals appear to have suffered greater physiological stress than their successors, likely reflecting seasonal or annual fluctuations in resource availability, and to have engaged in distinct activity patterns suggesting increased (and sexually disparate) logistical foraging in response to reduced residential mobility. However, remarkable parallels have also been observed between these two groups in terms of overall mobility, general health status, and numerous behavioral characteristics, suggesting a general pattern of continuity throughout the mid-Holocene period. Skeletal and dental data indicate that all occupants of the Cis-Baikal employed variable but effective adaptive strategies: despite their documented differences, both pre- and post-hiatus peoples appear to have been more than successful in exploiting the region's rich aquatic and terrestrial resources.

Behavioral plasticity among black-handed spider monkey (*Ateles geoffroyi)* communities in a mosaic habitat at El Zota Biological Field Station, Costa Rica.

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Land conversion practices resulting in deforestation pose a serious challenge to current conservation efforts. Arboreal forest-dwelling animals, such as primates, are especially at risk because of this activity. It is therefore imperative to assess the status of threatened species inhabiting anthropogenically dynamic landscapes. This study examines how *Ateles geoffroyi* uses a complex habitat mosaic in the lowland wet and swamp forests at El Zota Biological Field Station, Costa Rica. Surveys utilizing line transect techniques were conducted throughout the 1000 ha of protected land to evaluate the effects of anthropogenic disturbance on *Ateles* density. Transects were selected according to habitat type and degree of disturbance (plantation, gallery forest, secondary forest, swamp forest, mature and primary forest). Transect length totaled 6.6 km accruing a cumulative distance of 110 km from May-August 2005. Preliminary results indicate *Ateles* successfully utilizes a wide range of habitats at the field station. Adequate vegetation cover and food resources combined with minimal poaching activity support this interpretation. This study suggests behavioral plasticity is present among *Ateles* in response to regulated levels of tropical forest disturbance. Implementing similar conservation efforts on local and global levels, along with ample access to land management resources, can reproduce the conditions currently observed at El Zota.

The effect of substance abuse on skeletal development: how the study of teratology can benefit physical anthropology.

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With increasing frequency, physical anthropologists and skeletal biologists are being challenged to examine and evaluate bone specimens that have been exposed to several different environmental insults. It is important for these researchers to have a good understanding of the results being determined in other research areas such as teratology, where environmental insults are applied and then examined to determine the effects on development. For example, recent research in the field of Prenatal Alcohol Exposure has demonstrated how an environmental insult from the administration of alcohol during the critical period of intrauterine growth can impact the development of bone and that this effect on bone growth and formation can be long-lasting, well into adulthood. Such detrimental effects on bone growth have been shown in both irregular bones such as those in the craniofacial region and for long bones such as the tibia. The research presented here will examine the effect of alcohol and nicotine exposure during the critical intrauterine growth period on the on the development of long bones. Alcohol and nicotine are of particular importance because they are the two substances abused most commonly and conjointly during the period of prenatal development, and their consumption in the human population has existed for many years and across many different cultures. It is hoped that the results presented will provide critical insight into the processes regulating the development of bone and demonstrate the value of teratology research to the anthropology community, highlighting the value of cross-discipline collaborations.

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Characteristics of Pleistocene megafauna extinctions in Southeast Asia.

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The extinction of large bodied taxa from the Pleistocene in Southeast Asia is examined. Although the chronological resolution of these extinctions is poor, and number of excavations in the region relatively few, broad characteristics of these extinctions are described. Many taxa which became extinct appear to have been endemic to regions within Southeast Asia, while some taxa which experienced extinction or severe range reduction occurred in several regions. Members of the latter group include *Stegodon, Hexaprotodon, Palaeoloxodon, Pongo, Crocuta, Hyaena, Ailuropoda, Tapirus, Megatapirus* and *Gigantopithecus*. The loss of these species cannot be assigned to a single cause. Rather their disappearance is likely tied to both climatic and human agents. Unlike other regions which experienced megafauna extinctions, eustatic changes in sea level in Southeast Asia seems to have been an important factor.

Anomalies of dental development in modern humans and *Homo floresiensis.*

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The recent discovery of a dwarf hominin in Flores challenged consensus opinion on biological variation in the genus *Homo*. LB 1, the only complete specimen from Liang Bua, was determined to be an adult female, who lived approximately 18 ky ago, and was one meter tall, with an endocranial volume of between 380 and 417 cm^3. The maxillary dentition of LB 1 presents an anomalous feature - bilateral rotation of P^4 - which investigators described as an unusual anomaly not previously described in any hominin. This presentation places maxillary P4 rotation in evolutionary and genetic context by: a) presenting original data on P^4 rotation in living and prehistoric samples of *Homo sapiens*, b) reviewing clinical and pathological reports of rotation and associated

dental anomalies, and c) considering the evolutionary implications of dwarfism and dental anomalies in *Homo floresiensis*.

Axial rotation of maxillary P4s is not an uncommon dental variation, occurring with low but persistent frequencies in prehistoric and living South Asians and among the Guanches, prehistoric inhabitants of the Canary Islands. Rotation of maxillary P4s is clinically associated with reduced (peg-shaped) or absent maxillary lateral incisor teeth (I^2) and with reduced or congenitally absent maxillary third molars. The evolution of dwarf body size and the co-occurrence of a suite of dental anomalies (P4 rotation, I2 reduction and M3 agenesis) in *Homo floresiensis* are hypothesized to represent independent phenotypic consequences of geographic isolation or in this instance, the island effect. In *Homo sapiens*, this association of dental anomalies is significantly more common in females than males and is therefore consistent with its expression in LB 1.

The fate of the Greenland Norse: the undramatic version

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The Norse who settled and lived in Greenland AD1000-1500 provide a unique biological anthropological material for the investigation of human and environmental interaction. As a population, they were generally secluded from much of the contemporary European medieval society, and land suitable for their way of life was limited in Greenland. As such the Greenland Norse represent a relatively isolated population, constrained in both space and time.

The skeletal remains of 450 Norse individuals have been analysed in terms of morphometry and non-metric traits (indicating a homogenous population with no admixture); stable isotope analyses (indicating changes in diet as well as climate changes); and demographic modelling based on both archaeological and biological data (indicating that simple migration can account for the demise of settlements).

A further step will be clarifying the genetic history of the Norse. Evidently, the genetic history of the Thule culture Inuit must be examined also. We have started these analyses by looking at mtDNA variation, which showed complete absence of European mtDNA types in a sample of 82 Greenland Inuit. Furthermore, a study done in collaboration with British colleagues, found that Y-chromosomal diversity among present-day Greenlandic Inuit (N = 70) showed a strongly male-biased European admixture to Inuit, which although probably is due to 18th century Danish-Norwegian colonisation of Greenland.

Qualitative and quantitative assessment of infraorbital surface topography in recent and fossil *Homo*.

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Infraorbital morphology has long played a role in genus *Homo* systematics, particularly for *Homo sapiens* and Neandertals, each of which is argued to possess a unique infraorbital configuration. Most studies of the infraorbital region have utilized either discrete coding or single linear chord and subtense measures that have failed to adequately assess the complex topography of this region.

This study combines discrete coding and 3D morphometrics to evaluate variation across the entire infraorbital region of *Homo sapiens* and other members of *Homo*. Discrete coding of several infraorbital characteristics was conducted on 460 recent *Homo sapiens* crania from 9 globally diverse samples. 3D morphometrics was then conducted on a subset of this sample (n=67), and casts of Middle and Late Pleistocene hominids by using a laser to superimpose a standardized grid across the infraorbital region, and digitizing the resultant grid intersection points.

Discrete coding analysis reinforces that *Homo sapiens* is characterized by a depressed infraorbital region, with only 2.6% of the sample lacking depression. Principal components analysis following Procrustes superposition of the 3D landmarks reveals that PC1 explains 41.3% of infraorbital shape and contrasts infraorbital height and width, while PC2 (21.2%) contrasts degree of infraorbital depression. Both methodologies reveal lack of association between infraorbital depression and relative infraorbital width and height, geography, and sex in *Homo sapiens*. Interestingly, African Middle Pleistocene specimens with complete infraorbital regions share equivalent levels of flatness/convexity found in Neandertals, thus requiring a reassessment of the actual polarity of this trait in the broader genus *Homo* perspective.

A genetic analysis of an Indo-Costa Rican population.

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The Atlantic coast of Central America has been the recipient of large migrations after its Native population nearly disappeared following the invasion of Europeans. Best known is the migration of descendants of Caribbean African slaves, who were brought to Central America to work on the construction of the Panama Canal and the Costa Rican railroad or in banana plantations through the entire region. Less well known is the migration of people of East-Indian descent.

Since 2003, an international team of anthropologists has been working with a community of East-Indian descent located in Limon, Costa Rica. Initially, we collected hair follicles for genetic testing, but the follicles only yielded mtDNA markers. We subsequently collected buccal swabs for Y-chromosomal markers. As of the writing of this abstract, we have the mtDNA but not the Y-chromosomal markers ready for report. According to the genealogical reconstruction of the community by the cultural anthropologist in our team, we have at least a sample from each and every one of the mitochondrial and the Y-chromosomal lines in this group.

The mtDNA analysis yielded three haplogroups of East-Indian origin: M, U2a and R6. These haplogroups have been reported in different geographical areas of India, and confirms reports from informants that their ancestors came from different areas of the subcontinent. The mtDNA analysis revealed a strong founder effect in the Indo-Costa Rican population. In addition, the high frequencies of Indian haplogroups (not found in other Central and South-American populations) strongly indicate an Indian origin of this population.

Microwear and morphology: correlation between human molar microwear patterns and the mandibular corpus.

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The mechanics of chewing can influence the microscopic marks (microwear) on a tooth surface and the morphology of a mandible. Microwear can vary along the molar row, seemingly in response to the biomechanics of mastication. Aspects of jaw morphology, such as the size of the corpus, can reflect the forces generated while chewing. If both lines of enquiry overlap in the aspects of function to which they are thought to respond then they may the have potential to complement each other. The aim in the present exploratory study was to establish if microwear patterns along the molar row were correlated with the size of a mandibular corpus.

Digitized micrographs were taken with a scanning electron microscope at the bottom of facet nine on the first, second and third mandibular molar, from an archaeological sample of modern humans (n=38) recovered from Semna South in northern Sudan (100bc-ad500). The size and frequency of dental pits and scratches

were recorded from each micrograph and combined with size measurements taken from the corpus at the mid point of the first molar.

Microwear was correlated with corpus width. Individuals with a narrow corpus had significantly fewer and smaller (length, width) pits and narrower scratches on their first molar, compared to either their second or third molar. Individuals with a wide corpus had significantly longer scratches on their first molar, compared to either their second or third molars. Some of the correlations compared well to biomechanical predictions.

Study funded by the Institute of Human Origins, Arizona State University.

Sorting out population structure and demographic history of the Tigara and Ipiutak cultures using ancient DNA analysis.

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Since the initial excavations at Point Hope, Alaska (Larson and Rainey, 1948), scientists have been looking into the relationship between the pre-contact Tigara (800-300 bp) and Ipiutak (2100-1500 bp) cultures. Although dating is far from sufficient, these two groups appear to have separate temporal associations, in addition to distinct archaeological assemblages. In order to better understand the archaeological context of population movement and history in what was and continues to be a harsh locale vital to the peopling of the Americas, it is of fundamental scientific importance that we sort out the relationship between these two groups and their relationship to modern Inuit populations.

Exploratory ancient DNA analyses were performed on tooth dentin samples from five individuals associated with each group to establish the level of DNA preservation and begin to explore the genetic relationship of these groups. Approximately 300 bp from the first hypervariable segment of the mitochondrial D-loop was amplified in three overlapping fragments and sequenced.

Preliminary results show all individuals successfully sequenced were members of haplogroup A, which is found in frequencies up to 97% in modern Inuit populations. We will present preliminary phylogenetic and statistical analyses of the haplotypes to garner a clearer picture of levels of genetic variation, and the evolutionary forces acting upon these populations. Future work will entail DNA extraction from a larger sample size and more extensive analyses of mitochondrial and nuclear DNA sequences.

Public interest in genetic ancestry testing.

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The interest in genetic ancestry testing has grown exponentially over the last 5 years. Genetic ancestry testing companies began by marketing to a niche segment of genealogists, with an emphasis on Y-chromosome tests for surname studies. As the industry matured the interest in these tests has expanded beyond genealogists to include the general public. The number of companies offering these tests has grown ten fold and the types of tests offered range from mitochondrial DNA sequencing to biogeographic ancestry via the analysis of ancestry informative markers. These tests have also begun to be used to determine the inclusion/exclusion of individuals in sociopolitical groups such as Native American tribes and to give African-Americans a sense of connection to the land of their ancestors.

With this unprecedented growth in the industry, genetic testing companies have become the primary information providers on human biological diversity to the general public. In this presentation we will discuss the driving factors behind the growth in this industry and the challenges we face as genetic testing and information from DNA take on a more popular and prominent place in our society.

The socio-ecology of the silvery gibbon (*Hylobates moloch*) in the Cagar Alam Leuweung Sancang (CALS), West Java, Indonesia.

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Few data exist on the socio-ecology of silvery gibbons relative to other species within the Family Hylobatidae. Here we present information that will assist in the testing of ecological predictions for the evolution of hylobatid social organization and mating patterns. Data were collected from a small population of silvery gibbons (n=8 groups), and encompass the overall ecology of the reserve, including: a population assessment, evaluation of territory quality in both disturbed and undisturbed areas, within and between group social behavior, and a summary of anthropogenic influences. The majority of intragroup behavioral data were extracted from a single cohesive social group consisting of two adult males, a single adult female with a physiologically dependent infant, and a juvenile female. The exclusive territory of this group, at 6.25 ha, is the smallest within the sample (mean=14.86, SD=3.89) and well-below the reported average of 17 ha for the species (Kappeler, 1981, 1984). Behavioral profiles are discerned from focal group scan data, and results from the analysis of nearest neighbor and proximity maintenance data indicate stable social relations between both adult males and the adult female (and infant).

Historical and ongoing patterns of human disturbance are described, and implications for both species-specific conservation strategies and socio-ecological flexibility within the Hylobatidae are discussed. Our results from the analysis of remaining habitat, range use, and behavioral data confirm the importance of understanding inter-population variability in light of specific ecological and anthropogenic parameters.

We acknowledge the financial support of the Chicago Zoological Society, the Center for Asian and Pacific Studies at the University of Oregon, Sigma Xi, and the American Society of Primatologists.

Functional and evolutionary anatomy of the primate atlas: A geometric morphometric approach.

E. Manfreda, P. Mitteroecker, K. Schaefer. Dept. of Anthropology, University of Vienna

We present a geometric morphometric study to quantify the relationship between the morphology of the first cervical vertebra, the atlas, and the locomotion pattern within primates. The cervical vertebral column bears the weight of the head which is supported by the nuchal muscles connecting the cervical vertebrae with the head. The mass of the nuchal muscles might depend on how a species balance the head during locomotion as well as on the overall size of a species. All these factors may result in a specific shape of the atlas vertebra. In spite of these considerations, Ankel (1972) found that the vertebral morphology of Old and New World monkeys remains uniform and that the taxonomic identification of single vertebral elements at the generic level is nearly impossible.

Our analysis is based on a total of 116 vertebrae of *Homo sapiens, Gorilla gorilla*, *Pan troglodytes*, *Pongo pygmaeus, Hylobates lar, Macaca mulatta, Papio hamadryas, Ateles geoffroyi* and *Alouatta palliata*. On every atlas 56 landmarks were digitized and superimposed by a Procrustes registration. The ensuing shape variables were analyzed by principal component analysis, and multivariate shape regression.

We found that the nine primate species differ clearly in their atlas morphology.

The shape differences are even clear enough to allow a classification at the generic level. We could further identify morphological features that relate to the species' locomotion pattern. The shape of the human atlas cannot be predicted from human locomotion based on an extrapolation of the non-human primate model.

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A method for rejecting population histories using genetic data.

E.E. Marchani. Department of Anthropology, University of Utah.

I introduce a method to test proposed population histories via coalescent simulation. Input data include the size of the source and two daughter populations, the date(s) of divergence between the daughter populations, and the observed distribution of mitochondrial or Y-chromosomal haplogroups. The method estimates coalescent trees based on the population history entered,and identifies a specified number of haplogroups in each tree. The distribution of those haplogroups in each of the daughter populations is subsequently tested for a match with the observed distribution. The result is the probability that the proposed population history is consistent with the observed distribution of haplogroups in the daughter populations. Estimating the matching probability permits statistical testing of alternative population histories The resulting output probability can be used to reject both population histories as well as bottleneck severity indices, allowing for future data acquision and analyses to focus on more probable population histories, given the observed data.

The method has been used to evaluate alternative colonization scenarios for North American arctic colonization. All population histories with Eskimo/Inuit female effective sizes of 350 or greater were rejected, as were those population histories where the female effective population size of the Siberian Eskimos was less than 30. The size of the source population had no effect in determining which population histories were rejected. Results suggest that, although the most probable population histories involve a small effective population size of the Eskimo/Inuit, a severe bottleneck is not required to cause them to be monomorphic for mitochondrial haplogroup A.

Cross-sectional geometric properties of the tibia-fibula complex of Hominoidea, and their relationships with locomotor behavior

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The fibula has rarely been taken into consideration in anthropological studies, probably due to its relatively less important role in carrying load. However, looking at hominoids, the difference in morphology (and function) of the fibula between humans and apes, and within apes is evident, and is probably related to differences in positional behavior. Therefore, study of tibio-fibular relations may be useful in characterizing such differences. This study examines cross-sectional geometric properties (cortical area, CA and polar moment of area, J) of the tibia and fibula at 35, 50, 65% of bone length across a sample (N=105) of chimpanzees, gorillas, orangutans, gibbons, and humans.

All cross-sectional variables are analyzed against body mass x bone length. The fibula is compared against the tibia in the different groups. RMA lines are calculated. ANOVA is performed as well as post-hoc comparisons using the Tukey's honestly significant difference test. The calculation of the percent prediction error is used to evaluate differences between species.

When comparing the tibia against the fibula, it appears that gorillas and humans have relatively stronger tibia as compared to the other hominoids, and that orangutans and chimpanzees have relatively stronger fibula as compared to the other hominoids. Therefore, the lower limb polar moment of area appears to be useful in characterizing prevalently terrestrial versus prevalently arboreal hominoids, where the former appear to have relative more robust tibia than the latter. Further studies on the loading role of the hominoid fibula will be necessary to better understand the biomechanical role of this bone.

The sexual division of foraging labor among Hadza hunter-gatherers.

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The degree to which males and females target different foods and share them among human foragers stands in contrast to virtually all other vertebrates. Traditional explanations for this sexual division of foraging labor have increasingly been challenged over the past two decades. These challenges have raised the important question of whether the division of labor benefits the household or whether it results from males pursuing their individual interests. I use data collected over 3 years on Hadza foraging (out of camp) and food that is taken back to camp to examine this question and suggest ways we might answer it. Hadza women acquire predictable foods like tubers (40% of their total kcals arriving in camp) and fruit (49%) while men acquire less predictable foods, primarily meat (40%) and honey (30%). Although men's foods are shared widely outside their households, it appears that women and children in the average household benefit more from men targeting different foods than they would if men targeted the same foods as women and doubled the amount of those foods in the diet. Without food sharing across households, however, it is true that households with the least successful male foragers would consume fewer kilocalories of food than they would if men targeted women's foods.

Knuckle-walkers unite: separating plantigrade locomotors through talo-calcaneal facet morphology.

H.E. Marsh, J.M. Polanski. Department of Anthropology, University of Iowa.

In light of the continuing debate over whether hominins passed through a knuckle-walking phase, it becomes imperative to investigate any morphological signatures that can discern knuckle-walking locomotion. Previous research into this question has focused on the wrist. Can ankle morphology also help identify knuckle-walking, a locomotion more commonly associated with the forelimb? Gebo (1992) compared ankle morphology of the living apes (*Pan, Gorilla, Pongo, Hylobates*) and discovered six indices that separated the knuckle-walking great apes from the Asian apes. These differences are related to primate plantigrady, full plantar contact of the hind foot during locomotion, seen only in knuckle-walking apes and humans.

By selecting the indices that separate the knuckle-walkers from other apes, we investigate the ability of these indices to separate the two plantigrady groups, knuckle-walkers and bipeds, using talo-calcaneal measurements. Two of the indices present statistically significant differences between humans and the measurements of *Pan* and *Gorilla* within the areas of the subtalar joint and the talo-fibular facet. These indices relate to differences of weight transmission and joint stability in bipeds and quadrapeds, resulting from bipeds passing their weight through two limbs, and not four, as in apes.

Given that these indices do separate modern humans from their African ape relatives, talo-calcaneal morphology can serve as a powerful tool with which to investigate the origins of knuckle-walking in the fossil record. If extinct ape forms prior to the panin-hominin split show knuckle-walking indices, it is likely that last common ancestor of chimpanzees and hominins knuckle-walked.

Calcium consumption and bone density in factory and farm workers in central Mexico.

D.L. Martin, M. Cerullo, J.N. Bido, J.A. Colmenares. School of Natural Science, Hampshire College.

Mexico, with its intimate links to the United States through trade and migration, offers a compelling research site to investigate the consequences of economic globalization. One of the most dramatic transformations is in the economy of corn, whose nutritional and symbolic centrality to Mexican peasants' lives reaches back to pre-Columbian times. Anecdotal evidence suggested that substantial nutritional consequences accompanied the shift from a staple diet of native corn and traditionally made, calcium-rich tortillas to a reliance on imported corn and tortillas made with purchased flour. However, no systematic scientific investigation had been undertaken to test these effects particularly on Mexican farmers and the emerging populations of factory workers. Working with two locales in the state of Morelos - the subsistence farming region of the Sierra de Huatla and the municipality of Emiliano Zapata, where a number of foreign-owned assembly plants (maquiladoras) have recently located – we collected a combination of ethnographic and biological (body composition, bone density, calcium intake) data. Results indicate that a significant proportion of the adults in both populations have calcium consumption and bone density that is dangerously low. For example, 58% of the farm workers have bone density well below normal, and for the factory workers, 46% of the women have low bone density. Tortillas make up a large part of the daily diet of both groups, and a chemical analysis of tortillas revealed only 20 mg of calcium in the hand-made nixtamal tortillas, and a low of 6 mg in U.S. imported store-bought tortillas.

This 3-year project, “Feeding the Family in Troubled Times: A Biocultural Study of Patterns of Work, Consumption and Nutrition at the Household Level in Three Communities in Central Mexico” was funded by NSF Grant # 0354037.

The biogeography of Cercopithecini primates and its evolutionary implications.

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The Cercopithecini is an adaptive radiation including five extant genera and at least 20 extant species. The evolutionary history of this group is poorly known, with its reconstruction largely based on molecular data in the absence of any substantial fossil record. Researchers have suggested this clade experienced relatively rapid allopatric speciation due to the expansion and contraction of forests in equatorial Africa during periods of climate fluctuations throughout the end of the Miocene, Pliocene, and Pleistocene. The research presented here employs biogeographic methods to further investigate the evolutionary history of Cercopithecini. If most taxa evolved in allopatry during times of forest contraction, then there should be a positive linear relationship between divergence time among sister taxa and their geographic range overlap. Data for three molecular phylogenies and the geographic range of 20 Cercopithecini species were gathered from the published literature and analyzed using linear regression models. The results show that there is a significant positive relationship between divergence time and geographic range overlap among sister taxa and these results are robust to different phylogenetic hypotheses. Therefore, the results support previous interpretations of Cercopithecini diversification, and are consistent with paleoclimate data from Africa.

New temporal bones from the Middle Pleistocene site of the Sima de los Huesos (Atapuerca, Spain).

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The Middle Pleistocene site of the Sima de los Huesos has yielded the largest sample of fossil human remains in the world. The collection includes both cranial and postcranial remains belonging to at least 28 individuals of both sexes and different ages at death. A previous study described the temporal bone specimens recovered up to the 1997 field season, with a special emphasis on their phylogenetic significance. In the last eight years the sample has been significantly augmented, with the recovery of more than 40 new temporal bone specimens, including several nearly complete specimens. The enlarged sample provides an opportunity to re-evaluate the degree of variation in many morphological traits often used in paleoanthropological studies within a single Middle Pleistocene sample. The present study focuses on the most relevant traits in the new temporal bone specimens as well as in the entire sample, and this new evidence is discussed within the context of the European Pleistocene fossil human record. The Sima de los Huesos sample shows the derived Neandertal morphology of the glenoid cavity (i.e. a slender anterior wall and well developed postglenoid pocess), while the mastoid region lacks any of the Neandertal derived traits (i.e. anterior mastoid tubercle, strongly developed occipitomastoid crest, small mastoid processes and shallow digastric grooves). Thus, the enlarged Sima de los Huesos sample suggests that the derived traits of the Neandertal temporal bone did not appear collectively, but rather first in the glenoid cavity followed by the mastoid region.

Quantitative genetics and morphological integration in the human skull: a functional and developmental approach to heritability.

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The evolutionary potential of any biological quantitative character relies on the amount of genetic variation and its capability to respond to selection or other, nonadaptative, forces. In the case of complex morphological structures, such as the human skull, it also depends on its integrated nature, because association between traits can constrain potential for change. In fact, the human skull can be viewed as an integrated whole made up of several relatively independent subunits which have different developmental origins and which account for different functional requirements. Hierarchical modularity yields to integration within structures sharing common developmental pathways or functional basis. Covariation between cranial structures can thus restrict skull evolvability. Therefore, estimation of genetic variation and covariation of such structures is critical to incorporate craniofacial data in models of evolution of quantitative traits.

In this study, a skull sample from Hallstatt (Austria) with 353 complete skulls falling into extended, multigenerational pedigrees has been analyzed by means of 3D geometric morphometric techniques. Several modules within the human skull have been identified by analyzing covariance patterns between morphological components defined by functional and developmental *a priori* criteria, using a Partial Least Squares approach. Genetic parameters for size and shape of skulls have been computed following an animal model and by applying restricted maximum likelihood methods. Phenotypic, genetic and environmental estimates of variance are thus provided for each of the morphological craniofacial structures, showing different levels of plasticity and ability to evolve.

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Contradictions in the archaeological construction of the Ipiutak culture: Sedentary, stratified walrus hunters and/or nomadic caribou hunters.

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Much remains contentious about the site structure, demography, and subsistence at the Ipiutak site at Point Hope, Alaska, with its >600 houses and 150 burials. Radiocarbon dates (n=14) suggest that Ipiutak-like burials were placed as early as 200 BC, while the settlement was occupied AD 400-900. Population estimates range from a minimalist view of two or three households to several hundred, between 300 and 400. It is unlikely that Ipiutak was a summer trading *entrepot* attracting thousands of people. The archaeofauna, analyzed in the 1940s, reflect a subsistence focus on ringed, bearded seal and walrus, with only 10% caribou. Household inventories record ivory-working and sewing specialists and many with an arsenal of war-related arrow points, some recovered in cemetery-interred skeletons. Burials, placed in discrete precincts with functionally distinctive artifacts, vary drastically in associated decorated objects, suggesting a shaman-directed hierarchy; most have few or no objects. Year-round occupation (possibly sendentism) can be inferred from the substantial wooden houses and the high number of burials. An apparent reliance on wood for heat and no evidence of cache pits for storage remain problematic, but may be related to sampling strategy (houses in preference to extramural areas) or analytic constraints (unperceived alternatives to oil lamps). The presence of dogs without evidence of use in traction also remains problematic.

How good is Simpson's "sweepstakes" model in explaining the mammalian colonization of Madagascar?

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Simpson's sweepstakes dispersal model is the preferred explanation for the colonization of Madagascar by non-volant mammals (tenrecs, rodents, carnivores and lemurs), and holds that dispersal events that may be improbable at any limited period become much more probable over geologic time scales. We investigated the model from two standpoints, using lemurs as a paradigm case. First, we examined the assumptions underlying Simpson's statistics. Second, we modeled the fate of a pioneering population of lemurs, both as the occupants of a natural raft subjected to a range of environmental conditions, and being transported by an extreme climatic event like a tornado or a cyclone across the Mozambique Channel.

Simpson's assumptions are consistently violated when applied to scenarios of overwater dispersal by mammals. We suggest that a simple binomial is an inappropriate basis for extrapolating the likelihood of dispersal events, and that geometric models are more conducive to this type of analysis. Our models of current and wind trajectories show that the most likely fate for a raft emerging from an estuary on the east coast of Africa, is to follow the Mozambique current and beach back on the African coast. Given prevailing winds and currents, transport from Madagascar to Africa is much more likely than the reverse process. Freak transport by means of a hurricane or tornado is even less likely than rafting for mammals. Our models suggest that sweepstakes dispersal is not valid either at the theoretical or the applied level to explain the invasion of Madagascar by African mammals.

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Tooth wear in 3 dimensions: a longitudinal comparison of 2 widely differing populations.

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The wear on the same maxillary first molars of each of 7 individuals of Northern European origin from Burlington, Ontario, Canada and 28 Aboriginal Australians from Yuendumu, Northern Territory was studied over periods of up to 37 years in the former group while the latter was characterized over as much as 21 years. The wear was measured using moiré contourography and digital image analysis along with buccolingual and mesiodistal determinations. Areal, volumetric and intercuspal distances were accomplished indicating that in both groups there was a centrifugal movement of the cusp tips with wear while there were differing rates of these movements. Although the Aboriginals were younger than the Canadians they displayed heavier wear and more alteration in their tooth form over time. Males in both populations had heavier wear.

The changes in the morphology of the crowns of the groups indicated that the tooth changes its function with time. The molar's clinical crown initially increases in size followed by a reduction, movement of the cusp tips toward the periphery and a concomitant "sharpening" of the cusp and triangular ridges. These suggest that the tooth function changes from a mortar and pestle action to a more efficient cutting one.

A comparison of anthroposcopic and serological approaches to South Asian human population genetics.

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Population genetic comparisons have often been made using populations from the Indian sub-continent through the analysis of anthropometric, anthroposcopic (visually scored external morphological variation), and serological traits. Many anthroposcopic traits are reported by many to be under genetic control. To test this assertion, anthroposcopic traits are compared with serological traits in five endogamous groups in India. A special opportunity to compare anthroposcopic and serological traits was provided by the research of V. Rami Reddy in Andhra Pradesh. Using standardized methodology, Rami Reddy and colleagues collected data on eight anthroposcopic variables for 150 subjects in each of five endogamous sub-castes of the larger Reddis caste in the Chittoor District of Andhra Pradesh, and eight alleles at three genetic loci for serological polymorphisms from 250 individuals of the same five groups. Genetic distance analysis was performed on the two data sets. This showed significant heterozygosity between the sub-caste samples. Anthroposcopic trait average distances were consistently larger than the serological distances. On the other hand, the pattern of distances for the serological traits was more consistent with the expected patterns of gene flow according to social rank. The findings of this study indicate that there is greater inter-group variation among anthroposcopic traits than serological traits. This may indicate a compounding of environmental and genetic influences in the endogamous caste system. Use of anthroposcopic traits in population genetic studies should be undertaken with caution.

A new look at the early-middle Miocene mammal fauna of Jabal Zaltan (Marada Formation, Libya), with special attention to the biochronology and zoogeographic relationships of *Prohylobates*.

M.L. McCrossin. New Mexico State University.

The Miocene mammal fauna of the Marada Formation, best known from Jabal Zaltan, is re-examined. Because the Marada Formation yielded *Prohylobates simonsi*, its fauna affords unique information concerning cercopithecoid origins and diversification. In particular, the Zaltan fauna contributes to our understanding of the antiquity and zoogeographic relationships of North African victoriapithecids.

Previous studies concluded that Zaltan dates from 15-17 MA and that *Prohylobates tandyi* from Moghara (Egypt) dates from 17-18 MA. These results were based on the assumption that Zaltan and Moghara sample short time intervals, comparable to individual Miocene sites in eastern Africa, such as Maboko (15-16 MA). An assessment of the mammal faunas from Zaltan and Moghara, however, reveals that geographically extensive deposits in these areas sample different parts of a long time interval, mainly extending from 18-19 MA to 14-16 MA. These results show that it is not possible to pinpoint the geologic antiquity of early cercopithecoids previously collected from North Africa. Although *P. tandyi* probably dates to 17-18 MA, the presence of *Afrochoerodon kisumuensis* at Moghara raises the possibility that it may be coeval with Maboko *Victoriapithecus*. Proboscidean and hyracoid remains from northwestern exposures of the Marada Formation indicate that *P. simonsi* may date from the terminal Oligocene/basal Miocene.

Analysis of the zoogeographic relationships of mammal faunas from Zaltan and Moghara reveals a mixture of endemic North African, Eurasian, and sub-Saharan African elements. Several taxa from Zaltan and Moghara provide support for the establishment of a North African Zoogeographic Province near the beginning of the Miocene.

Ethnoecological knowledge and child health in lowland Bolivia.

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Local ecological knowledge transmitted across generations is important for habitat management, agriculture, health, and nutrition, and represents a central component of the human adaptive strategy. In particular, ethnobotanical knowledge may offer therapeutic options in societies with limited access to commercial medicines. Globalization threatens such knowledge to the extent that formal schooling and integration into emerging market economies devalue local knowledge and prioritize alternative sources of information. In this longitudinal study we investigate the association between parental ethnobotanical knowledge and child health among the Tsimane', a highly autarkic horticulturalist and foraging society in the department of Beni in Bolivia. Anthropometric data and capillary blood samples were collected from approximately 300 Tsimane' 2-10 year-olds, and mothers and fathers were interviewed to assess ethnobotanical knowledge and skills. Measures of parental schooling, acculturation, and economic resources were also collected. Dependent variables included four measures of child health: 1) C-reactive protein, assayed in whole blood spots as an indicator of infection; 2) hemoglobin, to indicate anemia; 3) height-for-age (z scores), to assess the degree of growth stunting; and 4) weight-for-height (z scores), to assess the degree of wasting. Analyses suggest that maternal and paternal ethnobotanical knowledge are significantly related to child health, as are measures of acculturation and wealth. In addition to its contribution to human capital and cultural diversity, the preservation of ethnoecological knowledge may have direct health benefits that may be threatened by the process of acculturation.

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A survey of *Alouatta pigra* in damaged forests on Monkey River, Belize.

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Habitat loss due to natural disasters can highly affect primate populations via environmental stress and/or changes in food abundance. Five forest transects were surveyed in Monkey River, Belize, Central America between January and June 2004. This area experienced extensive habitat damage due to Hurricane Iris in 2001. The goal of this study was to document the population parameters of *Alouatta pigra*, the Central American black howler monkey in Monkey River, an area that has been significantly impacted by a hurricane. This study found that, in the watershed area, the population density is 12.31 individuals/km^2 and the group density is 3.27 groups/km^2. These are low densities in comparison to other populations of black howler monkeys in Belize. Based on these numbers there has been an 89.56% decrease in population size and an 81.63% decrease in the number of groups since the hurricane. Along with this decrease, group sizes are small, the majority of groups are unimale, age ratios are skewed towards adults, and there is an even sex ratio. The monkeys were most frequently observed inactive, likely due to an increased consumption of low-quality foods: they were rarely seen eating higher quality food items like fruit or flowers. All of these variables indicate that *A. pigra* in the watershed area are under dietary stress because of a lack of resources since the hurricane. This study represents a critical step toward increasing our understanding of primates living in disturbed areas and provides insights into how they cope with habitat loss.

A critical analysis of the "wedge strategy" in Ohio

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"Change over time" used to be the only vague reference to evolution in guidelines for Ohio k-12 educators. Only in 2002 did the Ohio Board of Education adopt science standards that included indicators pertaining explicitly to evolutionary theory. However, evolution was also singled out as a controversial topic by requiring students to "Describe how scientists continue to investigate and critically analyze aspects of evolutionary theory." The following parenthetical compromise was added: "(The intent of this benchmark does not mandate the teaching or testing of intelligent design.)"

Thus the "wedge strategy," an attempt by proponents of Intelligent Design Creationism to reintroduce creationism via misleading criticisms, not critical analysis, of evolutionary theory, was inflicted upon Ohio's schools. This led directly to the development of a model curriculum module, adopted in 2004 by the Board of Education, portraying standard creationist criticisms of evolution as legitimate scientific controversies. Organizations such as the Discovery Institute tout this sanctioned lesson plan as a model for other states, thereby widening the wedge's impact.

The success of the thin end of the wedge in Ohio is a matter of politics, not science, as legitimate controversies and true critical analyses are absent. The Ohio science community will continue to work toward better k-12 education, and share experiences, resources, and tactics with those in other states who will see similar political movements against science education.

Sexual dimorphism in hominine supraorbital morphology.

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The supraorbital region is frequently used as one indicator of sex in fossil hominoid and hominin specimens. Known to be useful in distinguishing sex within modern humans and perhaps apes, morphology thought to be "robust" is usually designated as male, while more "gracile" forms are thought to be female. Less attention has been paid to metric variation between sexes beyond absolute size differences. Criteria of robusticity and size, however, assume either actual (when multiple specimens are thought to be conspecific) or potential (when only a single specimen is known) vectors of sexual dimorphism within extinct species. This can be especially problematic in hominoid specimens where the canines are not preserved and in hominins which are characterized by reduced canines.

This study used landmark-based morphometrics to test a null hypothesis of monomorphism in the supraorbital regions of extant African apes and humans. Patterns of shape differences between the sexes were then examined for each species. Results found significant differences between male and female means in all four species, albeit with substantial range overlap. The amount of total variability accounted for by sex is small, ranging from 6.6% in humans to 2.7% in *Pan troglodytes*. Moreover, patterns of shape differences between the sexes were distinct in all four species. These results recommend caution in the use of supraorbital morphology to diagnose sex among fossil specimens.

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Incidence of humeral septal aperture and its relation to population and sex.

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Septal apertures are circular openings of varying size that appear in distal end of the humerus, between the olecranon and coronoid fossae. The appearance of this non-metric trait has previously been associated with a higher prevalence in some population groups and in females, but this relationship has not been clearly defined. To this end, population and sex presently were investigated through observation of 1,154 humeri from six archaeological populations and the Terry Anatomical Collection housed at the Smithsonian Institution. Each humerus was sided and examined for an aperture. If applicable, the aperture was measured at its widest diameter and divided into one of four categories of increasing size. Sex and race information were noted on the Terry sample to assess sex and ethnic relationships; no sex identification was made for the archaeological samples.

The frequencies of septal aperture vary between 5 and 67 percent among the populations. The smallest frequencies belong to the individuals from Kagamil Island, Alaska and the Terry Collection. Three indigenous American groups from New Mexico, Illinois, and Ohio reveal septal aperture frequencies that are statistically similar. The Terry sample results indicate no sex bias within the White group (6-10 percent), but do show a significant frequency difference between the Black males (8 percent) and Black females (34 percent). The overall results of this study do not support sex determination of septal aperture. Further study needs to define trait frequencies to population-specific ranges that may allow for sex identifications based on this trait.

North to Alaska: Fieldwork among Kobuk Nunamiut and Koyukon Athabascans in the Summer of '63.

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Human biological fieldwork was initiated in the villages of Allakaket and Alatna in August of 1963 under the direction of Charles F. Merbs. These villages are located across from one another on the Koyukuk River in North-Central Alaska. The native language of Allakaket is Koyukon that has broader linguistic grouping with Na-Dene or Athabascans. Alatna people are ethnically affiliated with the Kobuk River Eskimos, a branch of interior Nunamiut Inupiaq speakers. The economic significance of the proximity of these two Native groups is that they once were trading partners. This report applied dermatoglyphic variation to investigate biological relationships between them.

Findings showed that for Allakaket Koyukon pattern intensity (PII =16.9) and finger ridge count (TFRC = 178.6) far exceeded corresponding variables for Alatna Nunamiut (PII=13.5 & TFRC =141.8). These results are in close agreement with those from a review done for Native North Americans in establishing that Eskimo/Inuits(20 village samples) and Amerindians(18 village samples) were markedly different in their dermatoglyphics in the time frame of the collected data from the past 75 years.

An underlying question that will be discussed is whether Na-Dene and Nunamiut shared a common origin in their migration to and then subsequently diverged while in the New World, or whether they are descendent groups of separate New World migrations that could well have had still earlier Asian connections.

mtDNA analysis of human remains from the Danish Iron and Viking ages.

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The results are obtained as part of the project "Denmark's Genetic Past", focusing on mtDNA from Danish prehistory. Teeth were used as DNA source and cleaning of these, isolation and purification of DNA were carried out in a dedicated aDNA-extraction lab with positive air pressure, frequent treatments with bleach, full body suits, extraction-lab and PCR-lab in different buildings and sequencing of multiple clones. All analyses were preformed in triplets, with the first two samples being analysed in our own lab by two different researchers while the third sample was sent to a reference lab.

At this stage of our project, we have haplotyped 34 individuals from four locations dating to Iron and Viking Age (ca. 900-2000 YBP). A surprising amount of haplogroup diversity was observed, indicating that the individuals are as different from one another as present day Danes. Three haplotypes, not observed amongst present day ethnic Scandinavians, were also observed; this may be evidence of connections with populations from far away regions.

The overall aim of our project is to haplotype (mtDNA) population samples from various times in the past (Vikings, Iron age, Bronze age, Neolithic and Mesolithic) and from various locations in Denmark, in order to look for population heterogeneity, maternal relationships, family and tribal patterns, population affinity and migration patterns.

This work is supported by grants from the VELUX foundation.

A histological analysis of *Alouatta palliata* dental enamel.

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Thirty permanent maxillary second molars from a wild population of mantled howler monkeys (*Alouatta palliata*) from Barro Colorado Island were analyzed histologically to determine: 1) normal *A. palliata* enamel macro- and microstructure, 2) M^2 crown formation duration, and 3) frequency of dental pathology. The results from the dental pathology study were then

compared to results of a skeletal pathology study [DeGusta and Milton, *Int. J. Primatol.* 19(3):615-650 (1998)] on the same individuals. Enamel thickness, daily increment width, and striae of Retzius periodicity and angulation are reported here. A subset of 10 individuals was selected to determine crown formation time using the method described in Shellis [*Arch. Oral Biol.* 29:697–705 (1984)].

Crown formation time is calculated as 419 days (min = 352 days, max = 492 days). The *A. palliata* M^2 crown begins formation with a high extension rate which slows cervically. Although the microstructure data for *A. palliata* does not vary drastically from data reported for other primates, inter-individual variation in crown formation is higher than might be expected.

Six pathological striae (PS) were noted in 5 individuals and 4 hypoplasias were noted in 4 individuals. However, only one individual exhibits both pathological indicators in association—supplying further evidence that the causes of these dental irregularities are likely distinct. A chi-squared test reveals no association between dental pathology and skeletal pathology in this sample. This dental pathology study supports the hypothesis that the BCI howler population is not chronically stressed.

Infant health: assessing adaptation and stability of transitional Early Neolithic subsistence economies in the Zagros Mountains.

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This research tests the hypothesis that children's health can provide invaluable information as to how people made a living, what they ate and how stable the population's biological and cultural adaptations to local conditions were. Evidence is derived from four Near Eastern human skeletal samples from the central Zagros Mountains, dated to between 8,000 and 4,000 B.C.

The transition to agriculture has been viewed as a rapid irreversible transition between two dichotomous stable states - hunting/foraging and farming - with good health and poorer health, respectively. However, a growing body of evidence indicates that 'transitional' economies based on herding supplanted hunting/foraging in the Zagros Mountains during the early Neolithic and that not all of these economies led to the adoption of agriculture.

This study combines traditional skeletal markers of health, correlations of dental formation and enamel prism cross-striation age estimates with long bone lengths, and Neonate (birth to one month of age) to Post-neonate (one month to one year) Ratios to assess children's health in these 'transitional' Neolithic economies. A model is then developed whereby the stability and success of these populations (i.e. ones focused on herding) can be inferred from the examination of infant skeletal remains. Results suggest that in non-optimal and unstable situations, as estimated by non-specific skeletal indicators of stress and by archaeological context, a higher proportion of infant deaths occurred in the Post-Neonate than in the Neonate period. This is consistent with ethnographic observations in modern non-Western contexts.

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A pilot survey of an endangered eastern simpona, *Propithecus diadema diadema*, in Betampona Strict Nature Reserve, Madagascar.

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Surveys are important conservation tools to estimate non-human primate population densities, assess geographic distribution and ecological needs, and monitor population trends over time to effectively implement conservation and management plans. While line transect survey techniques are discussed at length in the literature, there is a paucity of information regarding a standardized technique applicable to rare and cryptic primates that inhabit dense mountainous terrain, specifically lemur species in Malagasy rain forests. Here we test a census method known as 'recce-transect' at Betampona Strict Nature Reserve, northeastern Madagascar. This uses existing trails in conjunction with short line transects cut at intervals perpendicular to the trail that permit the relationship between an index of abundance and density to be evaluated. This method has not been used to census Malagasy primates prior to this study, although in principle seems highly suitable for the undulating terrain of the reserve and the rarity of *Propithecus diadema diadema*.

'Recce-transect' was found to be an ineffective method to survey *P. d. diadema* due in part to small sample size and time constraints. Thirteen individuals were found, which may be the total number residing in Betampona making hypothetical inferences about the population size based on a derived density estimate unnecessary and inaccurate. This technique may prove useful for more abundant taxa residing in the reserve, such as *Eulemur* and *Hapalemur,* and further emphasizes the need to improve the accuracy and general applicability of census techniques.

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Evidence for the anatomical capacity for spoken language in *Homo erectus*.

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Based on the singular fossil spinal column known for *Homo erectus* (KNM-WT-15000), it has been maintained that the spinal cord of this early human species was small and apelike, lacking a human level of innervation to respiratory muscles involved in spoken language. Thus, it has been suggested that this taxon had not evolved the capacity for spoken language. Recently, a second spinal column for *Homo erectus*, dated to 1.78 million years before present, was discovered at the site of Dmanisi, Georgia (Meyer 2005). The Dmanisi vertebrae are the oldest known for the genus, and present an important opportunity to reconsider the neuroanatomical potential for language in early *Homo*.

Comparative analyses against 2257 human, chimpanzee and gorilla vertebrae show that the raw and relative size of the Dmanisi spinal cord in all vertebral regions matched that of modern humans in its shape and size. The results suggest that early *Homo erectus* had evolved a fully human postcranial neuroanatomical substrate associated with fine control of respiratory muscles involved in spoken language. In contrast, this study confirms suggestions that the narrow vertebral canals of the KNM-WT-15000 vertebrae reflect a developmental pathology known as neural stenosis, and are unlikely representative of the taxon (Latimer & Ohman 2001; Meyer 2003). Thus, the evolution of the neuroanatomical capacity to produce spoken language appears to have been commensurate with the evolution of *Homo erectus* around 1.8 million years ago.

Intra-skeletal variability in osteon size.

E.R. Middleton, S.D. Stout. Dept. of Anthropology, The Ohio State University.

Osteon size is one factor potentially affecting techniques for age-at-death estimations. Researchers disagree on how osteon size varies among bones, with some authors contending that bigger bones have bigger osteons and others observing intra-skeletal similarity in osteon size. To explore intra-skeletal osteon size variability, osteons were measured from thin cross-sections of the femora, humerii, radii, and ribs of 15 individuals from a twentieth century cadaver collection. Mean osteonal areas were then compared across bones and individuals.

The average osteon areas of the femora and radii are significantly related, as are

the mean osteonal areas of the radii and humerii. The ribs show no significant relationship to any of the other three bones. Cross-individual comparison of the mean osteonal areas of all bones for an individual demonstrates that inter-skeletal variability exists. The observed intra-skeletal relationships are within the margin of variability observed by Stout and Gehlert (1979) for assigning mixed bones to individuals. The results, therefore, suggest that osteon size differs more inter-skeletally than intra-skeletally, which holds significance for forensic and bioarchaeological contexts.

Santeria, or why forensic anthropology IS anthropology.

E. Miller. Department of Anthropology, California State University Los Angeles.

Ritual crimes associated with "occult" religions have been on the rise since the late 1980s. A search of several anthropological and criminal science databases indicated no anthropological case studies on the interpretation of human remains found in ritual contexts.

Three ritual cases with human remains were recovered by the Los Angeles County Coroner. In the first two cases ritual items and human remains were recovered from outdoor contexts. In both of these cases the human remains were of medical/educational origin, available from supply houses and online sources (including e-Bay, the internet auction site). The third case involved the recovery of similar items and a modern cranium of forensic value.

The cases were originally felt to represent Santeria rituals. Human bone is used in some Santeria rituals, although human sacrifice is not commonly practiced and even the use of human remains is extremely rare.

Anthropological analysis of the cases, particularly case three, indicated the rituals were more likely of Palo Mayombe origin. Palo, although sometimes linked with Santeria, is a separate religion. Unlike Santeria, Palo relies on the dead for much of its power, and grave robbing is often used to obtain ritual implements. Palo is feared by followers of other religions, including Santeria. Based on the ritual items and the modern human remains, a more likely origin for the cases analyzed in Los Angeles County is Palo Mayombe – this anthropological finding will dramatically impact the investigative direction of law enforcement in solving these crimes.

Systematics of the Victoriapithecidae.

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The Victoriapithecidae is an extinct early to middle Miocene (ca. 20-12.5 Ma) family of Old World monkey. As the sister-group to modern cercopithecids, victoriapithecids play a pivotal role in our understanding of the morphocline polarities of cercopithecoids. At present only two genera and four species of victoriapithecids are recognized: *Prohylobates tandyi* (Egypt) (N=4); *Prohylobates simonsi* (Libya) (N=1); an unnamed species of *Prohylobates* (Kenya) (N=17); and *Victoriapithecus macinnesi* (Kenya, Uganda) (N=>2500). Much less is known about the morphology and adaptations of the various species of *Prohylobates* than is known for *Victoriapithecus,* due to small sample size, limited representation of skeletal and dental elements, and/or poor preservation.

We reexamined existing fossils of *Prohylobates* and *Victoriapithecus* and determined the following: 1) significant differences in the mandibular symphyses of *V. macinnesi* and *Prohylobates* from Buluk clearly indicate that the two species are distinct enough to belong in separate genera; and 2) species currently attributed to *Prohylobates* also differ from one from another in important features, including the development of lower molar roots, molar size sequence, size and development of the M_3 hypoconulid, degree of lower molar bilophodonty, and mandibular shape. Comparing the distribution of these traits to that seen among extant cercopithecoids indicates that the existing species of *Prohylobates* are best placed in distinct genera. In addition, morphological diversity within the *P. tandyi* sample may be too great to retain in a single species. Recognizing greater generic diversity among victoriapithecids has important implications for understanding the biogeography, biochronology and evolutionary trajectory of Old World monkeys.

This work is supported by The Leakey Foundation.

Sex differences in the activity budget and foraging patterns of the mantled howler monkey (*Alouatta palliata*).

J.R. Miller. Department of Anthropology, Bloomsburg University

This poster presents the results of a study of the foraging patterns and the activity budgets of adult mantled howler monkeys (*Alouatta palliata*) at La Suerte Biological Field Station, Costa Rica. The field study took place during January 2004 and was undertaken for the purpose of evaluating sex differences within sample populations drawn from three separate contiguous troops. The results indicate that this sample population exhibited significant sex differences in behavioral and foraging patterns. Statistical analysis revealed that males engaged in more frequent locomotor activity and less time feeding than females, as well as selecting lower quality foliage. For example, adult males allocated 3% of their daily activity budget to foraging, while adult females spent 15% of their daily activity in foraging. An even greater distinction occurred when the percentage of higher quality forage (such as young leaf buds) was calculated by gender – females spent approximately 20% of their daily foraging activity consuming leaf buds while no males were observed to engage in this behavior. Thus, the data suggest that disparities in nutritional requirements between males and females may be a critical factor driving differences in their activity patterns. The results are also compared to a number of published studies, including the seminal work of Milton, which included assessments of the food preferences of adult mantled howler monkeys. Finally, suggestions are addressed for more intensive projects with this species in the subject region, including more focused research parameters for investigating the nutritional implications underlying activity patterns between males and females.

Changing the definition of science: the new focus of anti-evolutionary advocates.

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Recent efforts by anti-evolutionary advocates have focused, not so much on science content, but on changing the definition of science itself. These efforts are expressions of widely held misunderstandings of the nature and limitations of science. The single word "natural" is the focus of a great deal of attention. Science is a methodology that provides a limited, but very fruitful, way of knowing about the natural world. This method works only if science confines itself to the investigation of "natural" entities and forces. This self-limitation is sometimes referred to as "methodological naturalism." Traditional creationists, and many intelligent design advocates, argue that science arbitrarily and unjustifiably excludes the supernatural from scientific explanations. They want to remove the word "natural" from the definition of science so that supernatural explanations can be admitted. This is a reflection of their false claim that science, and particularly evolutionary science, is inherently atheistic. However, science does not deny the existence of a Creator -- it is simply silent on the existence or action of God. Methodological naturalism simply describes what empirical inquiry is. It is certainly not a statement of the nature of cosmic reality. An important feature of science is that people

from any faith or culture can participate. They can do this because scientific knowledge is universally accessible. The attempt by anti-evolution advocates to incorporate the supernatural into science undermines this religious and cultural neutrality.

Assessing the nature of cranial robusticity: an examination of morphological integration between cranial superstructures and implications for the study of pre-modern hominins.

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Robust cranial superstructures are often cited as distinguishing characteristics that separate earlier hominin forms from modern *Homo sapiens*. Cranial robusticity has traditionally been studied with only single characteristics in mind, such as supraorbital or occipital tori. Other studies have indicated that cranial robusticity should be analyzed as a "complex" where superstructures are considered in unison to be informative in studying hominin craniofacial variation.

This study addresses the nature of robusticity expression in the crania of a sample (n=75) of recent *Homo sapiens* procured from the University of Iowa skeletal collection. Robusticity is tested using an integration framework (Cheverud, 1995), to determine if cranial superstructures (supraorbital torus, occipital torus, mastoid process, and zygomaxillary region) form modules, which are distinct units whose expression are independent of one another, or if their expression is integrated, meaning all robusticity elements co-vary together and as a result should be analyzed as a single "robusticity complex" in character analysis.

Results from geometric morphometric analyses including coordinate landmark matrix comparisons and relative warps analysis show a mixed pattern of integration and modularity within the cranial superstructures tested. Modularity characterizes most of the interactions between superstructures, but higher levels of integration of the mastoid process with the supraorbital and zygomaxillary regions, demonstrates that the expression of this feature may not be an independent module. This research highlights the importance of recognizing which superstructures are integrated, and as a result should *not* be studied in isolation or used as an independent character in the classification of unknown hominin taxa.

An analysis of human/ chimpanzee/ macaque orthologs.

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This study examines primate evolution under a comparative genomics framework. To date, we have extracted and aligned 6,831 orthologous coding trios from published sequences from the human (*Homo sapiens*) and chimpanzee (*Pan troglodytes*) genomes, and from a preliminary assembly of the macaque (*Macaca mulatta*) genome generated at Baylor College of Medicine. Estimates of synonymous (K_S) and non-synonymous (K_A) substitution rates have been used to test lineage-specific selection.

Of these 6,831 orthologs, 211 are significantly suggestive of positive selection in the human lineage, 255 in the chimpanzee lineage, and 70 in the human/ chimpanzee common ancestral lineage. Preliminary Gene Ontology distributions of these sequences reveal an overrepresentation of genes involved in cellular response functions, gametogenesis, and spermatogenesis in both the human and the chimpanzee lineages. This study, the first genome-wide analysis of human/ chimpanzee molecular evolution using the macaque outgroup, is especially informative in identifying coding sequences that evolved since the most recent common ancestor of the African apes and Old World monkeys. Capturing recent molecular evolution on this scale will lay the groundwork for more refined research, providing a valuable starting point for future analyses of specific genes and genetic systems that may have played an important role in hominid evolution.

*These authors contributed equally to this work. This study was supported in part by NIH grant HG 02238.

Association studies of obesity and high blood pressure to variants of the genes *LEPR, ADRB2 and ACE* in afro-derived Brazilian populations.

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Obesity and hypertension are common diseases determined by genetic and environmental factors. Many genes have been investigated as possible candidates in different population groups, but studies in African-derived populations are rare.

We studied a sample of 550 adult individuals from Quilombos populations, regarding the phenotypes of overweight/obesity (Body Mass Index ≥ 25 Kg/m^2) and high blood pressure (≥ 140/90 mm Hg). Quilombos are populations founded by runaway or abandoned African slaves. The eight populations investigated inhabit the borders of the rain forest in the state of São Paulo where they have remained as partially isolated populations until recently and thus, represent an interesting model for the study of diseases.

Variants of the genes *LEPR*, *ADRB2* and *ACE* are being investigated in all subjects in order to assess their effects on body mass index (BMI) and blood pressure. Preliminary analysis do not reveal significant associations between allelic and genotype frequencies in *LEPR*, *ADRB2*, *ACE* and high blood pressure. No significant associations were found between variants in *ACE* and *ADRB2* and overweight/obesity. A significant association was found between heterozygous genotypes at the *ACE* locus and high BMI in males. Other genetic and environmental determining factors are currently being investigated.

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The role of binocular vision in primate locomotion.

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Most vertebrates possess a binocular visual field, an overlap of the right and left visual fields, which contains cues that provide an accurate estimate of distance and three-dimensional shape. The additional sensory input, not present in a monocular field, may be involved in enhancing the perception of a visual scene or in controlling motor output. Primates have large binocular fields, and it has long been assumed that binocular vision played an important role in primate origins. Despite the importance of this assumption in models of primate evolution, no study has examined the advantage of binocular cues during specific behaviors.

To examine the role of binocular cues during locomotion we videotaped two *Lemur catta* in lateral view as they walked on a horizontal pole and on a series of rungs under monocular and binocular conditions. On rungs and poles, monocular animals exhibited increased crouching, higher maximum wrist position, and increased magnitude of peak vertical wrist velocities compared to binocular animals. Additionally, on rungs peak horizontal velocities were higher under binocular conditions.

These results suggest that at similar speeds subjects with occluded vision are less certain about distance estimates, and

compensate with temporal and kinematic changes that decrease the likelihood of a dangerous misstep. Current theories regarding primate origins lack experimental support for a functional advantage of forward facing eyes. This study provides the first evidence in non-human primates that binocular cues are used to guide precise movements and suggests one important proximate explanation as to why primates have forward facing eyes.

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The modular cranial development of humans, chimpanzees, and gorillas.

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Because dissociability of developmental processes is a prerequisite for the hierarchical organisation of higher animals as well as for complex adaptations, the concept of modularity is a crucial tool for understanding the evolution of development.

Inferences about modularity based on morphometric data are usually drawn from the covariance matrix of measured distances, log-distances, or shape coordinates of landmarks. We demonstrate another approach that is based on the ontogenetic sequences of different body parts assessed through their regional ontogenetic trajectories. When trajectories of different developmental modules differ in their geometry, there emerge more focused and reducible explanations of development than an overall analysis could provide. And whenever geometric relationships among trajectories of several species differ by region it seems appropriate to call those regions "evolutionary modules."

Using 333 anatomical landmarks and semilandmarks, we compared postnatal cranial ontogenetic trajectories of humans, chimpanzees, and gorillas. The three facial trajectories are clearly distinct, similarly oriented, and almost linear. The neurocranial trajectories for *Pan* and *Gorilla*, in contrast, are very similar in shape space, but the *Gorilla* trajectory is extended nonlinearly. The shorter neurocranial trajectory of *Homo* diverges from the apes. These results confirm that the face and the neurocranium are not only developmental but also evolutionary modules. We will, in closing, speculate about specific evolutionary scenarios consistent with these observations.

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Adverse environments: investigating local variation in child growth and health.

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Epigenetic and life history approaches to child growth are centered on the relationship between the organism and its environment. However defining and operationalizing the concept of environment is challenging, in light of the multiple variables that influence growth. Human biologists whose focus is health rather than adaptation face a similar challenge when attempting to link biological outcomes to proximate and distal environmental factors. This paper presents a study of children living in three neighborhoods in the City of Hamilton, two of which are considered adverse environments on the basis of low socioeconomic status, and their inner-city locations. In contrast to children living in the higher socioeconomic status area, children in these adverse environments display unhealthy growth indicators. While both these inner-city neighborhoods constitute adverse environments, they differ in ways that have a significant impact on children's growth. One of the neighbourhoods is both low-income and multi-ethnic, comprised of a number of refugee and new immigrant families living in poverty and the other is comprised of mostly Canadian-born children living in poverty. We argue that the growth of low-income, immigrant children is influenced by both spatial and temporal aspects of the environment, including geographical location, immigration and refugee status, and intergenerational factors such as maternal growth and development. We argue for a definition of "adverse environment" that is broadly based, incorporating a range of physical, social, and temporal factors that are highly localized and sensitive to community-level influences on growth and health.

Mitochondrial DNA variation of Yuman speaking populations.

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Mitochondrial DNA (mtDNA) has been instrumental in aiding reconstruction of North American prehistory and determining population relationships. However, in the Southwestern United States, limited sampling of Yuman speaking populations has restricted the ability to draw conclusions about genetic relationships between these populations, as well as with other, non-Yuman speaking populations. We, therefore, conducted a more extensive study of mtDNA variation to address these issues. Approximately 300 samples from the Yavapai, Quechan, and Havasupai were categorized as belonging to one of the five New World mtDNA haplogroups: A, B, C, D, or X. Haplogroup frequencies as well as hypervariable region sequence data were used to assess the relationship of these populations with previously studied populations from the Southwest, Baja California, Mexico, and Southern California. One of our preliminary findings is that the Yavapai experienced higher levels of geneflow with Athabaskan speaking populations than previously determined. Additionally, this data suggests that Yuman speaking populations are not homogeneous and display genetic differentiation despite linguistic affinity.

Prehistoric peoples and ancient migrations: Exploring population affinities in East Eurasia.

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The population history of females has been extensively deduced through the characterization of global mtDNA diversity in modern populations, providing a broad depiction of the migration of females throughout the world since the emergence of modern humans. To truly understand how observed global mtDNA diversity has come to pass, one must consider gene flow and migration over multiple temporal boundaries, something that is possible only with the inclusion of ancient DNA (aDNA) analysis. Over the last several years, we have been working to characterize the matrilineal population structure of groups who lived in the Lake Baikal region of Siberia from the Neolithic onwards. To date, this has been accomplished through the extensive aDNA sampling of three cemeteries which were geographically and temporally disparate. Our findings to date show that the matrilineal genetic structure of prehistoric Lake Baikal is surprisingly diverse with mtDNA lineages from haplogroups A, C, D, F, G2a and U5a as well as undifferentiated M and N types (Mooder et al., 2003; 2005, in press). Building on these findings, this current study has several aims. Firstly, by integrating our Baikal data with all other aDNA datasets published for East Eurasia, we strive to create a comprehensive snapshot of the prehistoric matrilineal population structure of this region. Secondly, by comparing modern and aDNA datasets for East Eurasia, we aim to evaluate the temporal stability of the matrilineal population structure. Thirdly, by integrating the combined mtDNA data with information gleaned from the archaeological and climatic re-

cords of East Eurasia, we endeavor to construct a model describing the prehistoric dispersals of females throughout East Eurasia and beyond. In doing so, we hope to provide a portal through which another piece of the human evolutionary puzzle may be viewed.

Social Sciences and Humanities Research Council of Canada, Canadian Circumpolar Institute and May and Stanley Smith Charitable Trust.

Initial investigation into the puncture and crushing resistance of food and nonfood items of the Tana River mangabey (*Cercocebus galeritus*).

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Although *Cercocebus* mangabeys are known to have powerful jaws, no previous studies have been conducted on the physical properties of diet items consumed by any *Cercocebus* species. This study was undertaken to measure puncture and crushing resistance of food and nonfood (e.g., fruit punctured to eat seeds) items of the Tana River mangabey (*C. galeritus*), a critically endangered primate endemic to Kenya. Two groups were followed for three consecutive days each month beginning July 2005. Items of the same stage of ripeness consumed were collected from trees in or under which the mangabeys were observed feeding. Puncture resistance of fruit was measured using a portable agricultural fruit tester (Model 719-40MRP, Chatillon & Sons, Inc.) and crushing resistance of seeds was measured using a valve spring tester (B4172, RIMAC). Average puncture resistance of fruit ranged from 0 kg for ripe *Rauvolfia mombasiana* (n = 21; all 0) to 10.4 kg for ripe *Saba comorensis* (n = 8; range 9.2 – 12; SD = 1.0). Of seeds eaten in July and August, only the crushing resistance of *Diospyros mespiliformes* measured greater than zero. The average was 28.3 kg (n = 53; range 0 – 62.5; SD = 23.7) for unripe and 39.3 kg (n = 22; range 11 - 67.5; SD = 17.1) for ripe *D. mespiliformes*. These values are within the published range for other primates. Additional items will be measured as data collection continues. Dietary flexibility plays a critical role in the mangabey's adaptation to its greatest threats, habitat degradation and destruction.

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Hand preference during feeding in white-faced capuchins (*Cebus capucinus*).

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Across extant humans, there is an approximate 90% right-hand preference for a variety of tasks. To determine how prevalent and longstanding this feature is in the order *Primates*, researchers have studied hand preference in nonhuman primates. Research conducted so far has produced inconclusive results. The majority of these studies have been on captive animals, particularly the great apes. Although individual hand preferences for particular tasks have been demonstrated in different species, the only population-level result has been found in chimpanzees (*Pan troglodytes*).

This study focused on a group of white-faced capuchins (*Cebus capucinus*) at La Suerte Biological Field Station in Costa Rica. Capuchins have the largest relative brain size of the New World monkeys and have fine manipulative skills, both characteristics that have been proposed as precursors to the evolution of handedness and brain laterality.

A group of fourteen capuchins was observed for a period of two weeks. Data was collected in focal samples consisting of three minute bouts while animals were feeding, and recorded as right, left, or bimanual. Feeding was defined as the placement of any food object in the mouth using the hands. At least thirty data points were collected on each animal. Although there were some individual preferences while feeding, the results demonstrated no group-level hand preference. This study contributes to others in suggesting that handedness evolved after the split of New and Old World primates, or that this characteristic did not evolve simultaneously in *Cebus capucinus*.

Creating a statistical atlas of femora from three-dimensional CT data.

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Quantifying bone shape variation remains one of the most fundamentally important tasks in biological anthropology. Geometric morphometric techniques are increasingly replacing traditional linear measurement. The requirement of corresponding landmarks, however, has made the application of these techniques to the post-crania difficult since most bones lack sufficient well-defined landmarks. This study describes data collection and creation of a three-dimensional statistical shape atlas of the human femur from computed tomography data.

381 individuals from the William M. Bass Donated Skeletal Collection, housed at the University of Tennessee, were scanned using a GE Lightspeed 16 Slice computed tomography scanner. Specially designed scanning boxes were created to facilitate later data processing and a bone density phantom was used to calibrate the attenuation rate for approximately 15% of the scans. Manual segmentation of JPG images (converted from Dicom) was carried out on 49 femora and resulted in three-dimensional triangular mesh models for each bone. The models consist of between 800,000 and 1,000,000 coordinate data points.

To make the models more compatible with morphometric techniques, evenly distributed data points were created across the surface of each bone. This was accomplished by aligning and deforming a 'template' femur to all other femora. The 'template data points were then projected onto the surfaces of the other femora, creating 7500 evenly distributed data points for each bone. PCA was used to describe the shape variation within this sample. The first 10 principal components capture 99.6% of the variation, with 96% captured by the first component.

Nutrition and lipids in a population exhibiting very low levels of serum cholesterol: The Western Buryat of Ust Orda, Siberia.

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Dietary manipulation to lower elevated serum lipids is widely accepted as an initial step addressing dyslipidemias, yet current research demonstrates inconsistent results. Moreover, dietary manipulation frequently reduces the beneficial high-density lipoprotein (HDL) along with the detrimental low-density lipoprotein (LDL) and triglycerides (TG). Most research is completed on populations with elevated serum lipids. Therefore, we examined the role of nutritional variation on serum lipids among Western Buryat of Siberia, a population exhibiting very low lipid levels.

We collected fasting plasma lipids, anthropometrics, basal metabolism rate (BMR), and dietary data from 38 men and 48 women. Mean total cholesterol, HDL and LDL were similar (137m/dl, 39mg/dl and 86mg/dl respectively) for both sexes. Only TG differed significantly (92mg/dl in males, 79mg/dl in females; P=0.02). Macronutrient composition in total energy intake (TEI) was also similar in males and females. After adjusting plasma lipids for sex, age, BMI and BMR, TEI was an independent predictor of HDL variation only (P=0.02, r^2=0.05), whereas, none of the individual macronutrients were signifi-

cant predictors of plasma lipids. Using sex-stratified samples, TEI was significantly correlated to HDL variation in males only (P=0.004, r^2=0.23). Nutritional effects were not significant predictors of LDL or TG in either sex. These results suggest males may be more vulnerable to the negative effects of dietary manipulation than females. Further investigation of sex-specific effects of diet on plasma lipids is needed on larger populations.

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Ecogeographic size variation in small-bodied subfossil primates from Ankilitelo, SW Madagascar.

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Geographic variation in body size is well documented for both extant Malagasy primates and giant subfossil lemurs. Less attention has been paid to extant lemur specimens in subfossil collections, although Godfrey and colleagues (1999) have shown most extant species found at subfossil sites are characterized by greater size. They hypothesized that this trend towards "gracilization" may be related to a shift to drier conditions between 2000-3000 years BP. The objectives of this study are to examine size variations in subfossil small-bodied primates within a regional comparative context to determine if Holocene primates and modern forms exhibit similar ecogeographic patterns.

We report on a uniquely rich subfossil assemblage from Ankilitelo, southwestern Madagascar dated to the late Holocene (~500 BP). The Ankilitelo primates are compared with 570 museum specimens with associated locality information. Extant taxa are assigned to one of five distinct ecogeographic regions, including spiny thicket, dry deciduous forest, succulent woodland, lowland and subhumid rainforest. Comparisons of dental morphometrics reveal significant geographical patterns of size variation within taxonomic groups. In general, the primates from Ankilitelo are both: (a) larger than their modern counterpart, (b) consistently larger than similar taxa from localities that are further south, but smaller than similar taxa from the forests in the north and east. This suggests that variations in size in the Holocene forms can be related to broad scale habitat type. The predictive value of ecogeographic patterns in Holocene primates is of significance for the reconstruction of paleoenvironments in Madagascar.

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Bone microstructure in chimpanzees.

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This study addresses the need for more data on the bone microstructure of nonhuman primates in general and pongids in particular. The purpose of this study is to assess the bone microstructure of juvenile and adolescent chimpanzees.

The study sample includes femoral and humeral midshaft thin sections from 12 juvenile chimpanzees, ranging in known age from 2-15.3 years. For each specimen, numbers of osteons, osteon fragments, forming osteons and resorption spaces were counted for sixteen fields. Haversian canal areas and osteon areas were also measured throughout the cortex.

In the femur (n = 12), osteon population density (OPD), including the number of osteons and fragments, is 4.13 ± 2.17 per mm^2. Haversian canal area is .0016 ± .0005 mm^2 and osteon area is .033 ± .006 mm^2. In the humerus (n= 8), OPD is 4.19 ± 1.51 per mm^2. Haversian canal area is .0013 ± .0003 mm^2 and osteon area is .033 ± .005 mm^2.

In the femur, age predicts 48% of the variation in number of osteons and 63% of the variation in number of forming osteons. Other variables did not exhibit significant relationships with age or sex. In both the humerus and femur, significantly more osteons were present in the endosteal cortex compared to the periosteal cortex ($p<0.05$ and $p< 0.01$, respectively). These results will be compared with other published studies on bone microstructure in nonhuman primates.

Migrations across the Red Sea: Mitochondrial DNA analysis of populations from the Horn of Africa and Arabia.

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Horn of Africa (HOA) and neighboring regions on the Arabian Peninsula are critical to our understanding of the worldwide dispersal of anatomically modern *Homo sapiens*, as well as the reconstruction of more recent migrations between the two regions. We generated mitochondrial DNA sequence data from the hypervariable region I (HVRI) for Ethiopian (n=40), Yemeni (n=44) and Ashkenazi (n=45) Jewish populations. A collected comparative database of HVRI sequences was used to expand our dataset to include multiple HOA and Arabian populations. We performed network analyses using median joining methods implemented in Network v.4.1 (Bandelt et al 1999).

Overall, African-specific L haplotypes represented ~37% and ~27% of the variation present in Ethiopian and Yemeni Jews, respectively, in contrast to non-Jewish populations in these regions where African and Eurasian haplotypes were represented in almost equal proportion (Kivisild et al. 2004). Haplotypes L1a1, L1a2 and L5a1 were detected at 0,0, and 7.5%, respectively, in the Ethiopian Jew population in our study in contrast to a similarly defined population in which these haplotypes were present at 8.3%, 21%, and 0, respectively (Thomas et al. 2002), emphasizing the need for additional sampling in HOA. A starburst of pre-HV-1 sequences in a network analysis of the Ethiopian and Yemeni Jews lacked depth relative to the rest of the network and was consistent with a back-migration event into both populations, possibly from the Middle East. Future work includes sampling of Eritrean and Omani populations as well as simulation studies to model specific migration scenarios.

Caboclo household food consumption in two Amazonian ecosystems: a comparative analysis.

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The objective of this study is to compare preliminary data on household food consumption of caboclo populations settled in two different riverine ecosystems in the lower Amazon: a terra firme (upper-land forest) environment in the Caxiuanã National Forest and a floodplain environment on Ituqui Island. Data on household food consumption were collected using 24-hour recall in 1995/1996 on Ituqui Island and in 2004/2005 in Caxiuanã. Structured interviews were undertaken in 12 households with female heads in each population during 7 consecutive days in the two main seasons of the year (rainy and dry). Caloric and protein values were calculated using the three major Brazilian food composition tables.

Preliminary results show significantly higher caloric (P=0.001) and protein (P=0.002) intakes in the Caxiuanã population in comparison to the population in Ituqui. Caxiuanã also shows higher values of caloric and protein intakes when the two most important food items, fish ($P_{calorie}$ = 0.018, $P_{protein}$ =0.048) and manioc ($P_{calorie}$=0.025, $P_{protein}$= 0.029) are compared.

The differences observed between the two populations are most likely related to higher resource diversity in the terra

firme environment, as well as less seasonal environmental extremes observed in the flood-stressed environment of Ituqui. In addition, the lower dependency of the Caxiuanã population on market products for meeting dietary needs may also play a role in the obtained results.

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Fordisc 2.0 the ultimate test: What is the truth?

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Numerous researchers have used archeological populations to test the ability of Fordisc 2.0 to classify an unknown adult cranium based on a worldwide reference sample. The reference consists of twenty-eight sample populations from W. W. Howell's (1989) data base. Williams et al. (2005), Belcher et al. (2002), and Leathers et al. (2002) have used a small homogeneous X-Group population from Sudanese Nubia (350-550 CE) to demonstrate problems with the program. Freid et al (2005), in "The truth is out there: how NOT to use FORDISC," charge that using the Nubian archeological population is an inappropriate use of Fordisc 2.0 since there is not a representative sample in the Howell database. In this test, we use crania from Howell's representative Egyptian sample to assess the performance of Fordisc 2.0. Of the 111 Egyptians, only 55 (49.5%) were correctly identified with significant statistical evaluation (posterior probability greater than .500 and a typicality above .100). Sixteen (14.4%) were classified as Egyptian without the statistically approximate value and, according to Freid et al., are considered unclassifiable. Fourteen (12.6%) are misidentified with results of appropriate statistical significance. Twenty-six (23.4%) were misidentified but without statistically significant results. The inability of Fordisc 2.0 to classify even half of the representative sample reaffirms earlier assessments that Fordisc is seriously flawed. Cranial variation, even in the one of the core samples, is too great to be reliably classified as belonging to that sample, thus highlighting issues with the use of geographic population (race) in anthropology.

Variation in cranial bone thickness in a single population of *Papio c. anubis*.

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Cranial bone thickness has been a significant morphologically defining characteristic for modern humans and fossil hominids. Although evaluated for various "ethnic" populations, the comparisons for nonhuman primates have not focused on the correlates of variability. This study compares the variability of cranial bone thickness in various regions of the adult cranium in a population of *Papio cynocephalus anubis*. The 37 (17 male/20 female) specimens used in this study were obtained from the Tappen collection, Department of Anthropology at the University of Minnesota, Minneapolis. Palatal length (prosthion to staphylion) and thickness measurements taken at midfrontal squama, right pterion, left pterion, basion, and opistion were recorded using a Mitutoyo Digital caliper and a modified sliding caliper with extendable arms, read to the nearest (.01mm). Mean absolute and relative (absolute point/palatal length) thickness at each of the five points was computed for males and females. Student's t-test was used to compare means between male and female values. Two of five absolute measurements (basion and opistion) were significantly different ($p<0.05$) and three of five relative measurements (midfrontal squama, right pterion, and left pterion) were significantly different ($p<0.05$). The two absolute points were both on the foramen magnum with males exhibiting 18% thicker bone. The three relative points exhibit greater values in females than in males. This is not surprising since palatal length is 25% greater in males than in females. Studies such as this will help in the interpretation of variability of cranial bone thickness in various populations of primates and fossil homininds.

Osteoarthritis as a behavioral indicator: Patterning versus pathology.

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Although behavioral interpretations based on the appearance and severity of osteoarthritic changes on joint surfaces have come under fire in recent years, another method simply evaluating the precise location of these changes remains a viable and underutilized approach. This paper evaluates the utility of this method, using data collected from two prehistoric Kentucky skeletal collections.

The idea that patterning of osteoarthritic changes may reflect habitual activity is supported by the data in a number of ways. *1. The patterning is not random*. Multiple individuals had changes in precisely the same location on a joint. *2. The patterning is not homogeneous*. For many major joints, more than one pattern (each involving multiple individuals) could be discerned. *3. The patterning seen is consistent with biomechanical information*. In other words, they correspond to actions and positions to which that joint may be subjected. *4. Frequencies of different patterns vary significantly both within and between populations*. Males and females in the same population vary markedly, as do individuals from temporally distinct populations.

Taken together, this data strongly suggests that regardless of underlying causative factors and degree of severity, the specific placement of osteoarthritic changes on a joint surface very likely reflect the biomechanical forces applied to that joint during habitual activities.

Late Miocene primate fauna in Nakali, central Kenya.

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The Nakali area is located on the eastern shoulder of the central Kenyan Rift, 60km south from the Samburu Hills, and 80km northeast from the Tugen Hills. In 2005, the Japan-Kenya Joint Expedition collected fossils of a large- and a small-bodied apes, and a colobine monkey *Microcolobus* from Nakali. Their age was dated as 10.0Ma by $^{40}Ar/^{39}Ar$ method. Large hominoid materials include a large (=male) mandibular fragment with heavily worn $M_{1\text{-}3}$ and large and small (= male and female) isolated teeth. The size of the male specimens is equivalent to that of female gorillas. Compared to the almost contemporaneous *Samburupithecus* (9.5Ma), this hominoid is smaller in size, and exhibits less specialized crown external morphology of molars. The other "ape" is represented by a mandibular fragment with $M_{2\text{-}3}$. The molars display the crown morphology resembling African Early and Middle Miocene small "apes" and the overall size is smallest among them. It may be the latest survivor of the African small "apes". The presence of multiple "apes" in this confined area (Nakali and Samburu Hills), which are supposed to be tropical forest periphery in those days, might suggest that a diversity of non-cercopithecoid catarrhines had been retained at least by 10Ma in Africa.

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A comparative analysis of the relationship between head posture and occipital condyle orientation in anthropoids.

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The hypothesis that posture influences aspects of atlanto-occipital joint morphology has a long and persistent history. Many researchers have focused on the occipital condyles and foramen magnum, historically using their position and spatial orientation in relation to other anatomical landmarks to determine taxonomic affinity or to discuss locomotion and posture. Unfortunately, due to the irregular shape of the basicranium, anatomical descriptions are commonly restricted to qualitative characteristics and 2D measurements. These previous methods revealed the effects of increasing brain size, but failed to elucidate the influence of posture. Thus, 3D quantitative research is more appropriate to analyze aspects of atlanto-occipital joint morphology that indeed reflect posture.

This study targets the occipital condyles and quantifies the orientation of the articular surface plane. Three-dimensional computer models obtained from 17 anthropoid species (n=57) are used to explore the relationship between articular surface angles and head posture. Two null hypotheses are tested: 1) Pronograde anthropoids exhibit posterior facing facets and acute angles to the reference plane whereas orthograde anthropoids reveal anterior facing facets and more perpendicular angles to the reference plane and 2) Early hominins demonstrate orientations within modern human ranges. Preliminary results indicate a functional affiliation between articular surface plane and head posture after correcting for body size. The morphology of fossil hominin specimens supports the second null hypothesis and is discussed within the comparative framework of the primate sample.

Primates on the periphery: Current research on the biogeography and paleoecology of fossil primate localities in the Pannonian Basin of Central Europe.

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The Pannonian Basin, surrounded by the Carpathians, Alps and Dinarids, has long been known as a sedimentary catchment area rich in information on the climatic and biological evolution of Central Europe in the middle and late Miocene. Primate diversity in the Pannonian Basin is high and includes *Griphopithecus*, *Pliopithecus*, *Dryopithecus fontani*, *Epipliopithecus* (MN6-8), *Dryopithecus brancoi*, *Anapithecus* (MN9), *Mesopithecus* (MN11) and *Dolichopithecus* (MN13?). Our current research on the fossil localities located along the margins of this basin is described here.

Our surveys in the Pannonian Basin have identified over 60 localities in Hungary, Romania and Croatia. We used ArcGIS 9.0 to model the spatial distribution, geological, faunal and paleoenvironmental attributes of these localities, which include known primate occurrences at Mariathal, St. Stephan, Göriach, Klein Hadersdorf, Götzendorf (Austria), Devínska Nová Ves (Neudorf, Slovakia), Felsőtárkány, Rudabánya (Hungary) and Taut (Romania). Layering biotic and abiotic data over consecutive time slices reveals a shifting pattern in the geographical distributions and ecology of these vertebrate localities. This includes the extinction of non-cercopithecoid catarrhines and other forest dwelling taxa and the appearance of open country taxa, including cercopithecoids.

Fossil taxa from the Pannonian Basin document multiple dispersal events within Eurasia and between Eurasia and Africa. These events are thought to correlate to changes in climate, basin margin topographic relief, basin water levels and the evolution of a brackish late Pannonian lacustrine environment from fully marine and epicontinental precursors during the middle and late Miocene.

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Effects of moonlight levels on behavior of *Lepilemur leucopus* at Beza Mahafaly Special Reserve, Madagascar – do alternative analyses give the same answer?

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Several nocturnal primates show increased activity with more moonlight, but little is known about nocturnal lemurs. Moonlight effects on behavior may be related to changes in predation risk at different light levels. Adult *Lepilemur leucopus* (1 female, 6 males) were radiotracked in riverine forest for focal follow observations across 7 months for about 50 hrs/individual. Activity budget and substrate height were assessed at 5 min point samples. Calling was measured as (1) focal's calls as 1/0 scores within 5 min intervals, and, (2) an index of amount of calling by other *Lepilemur* in the focal's vicinity. Moonlight level was measured relative to both moon phase and moon rise/set times. Moonlight effects were tested using the individual, the point sample, or the animal-night as the unit of analysis and test results compared. Activity budget did not change with moonlight level. Animals spent more time in the highest substrates during dark moon times ($p<0.05$). Calling by focal individuals did not change with moonlight level, but the index of calling in the focal's vicinity was greater when the moon was bright ($P<0.05$). In general, all approaches gave similar results. *Lepilemur's* folivorous diet may constrain energy available for activity budget changes. Highest tree zones may expose animals to visual aerial predators, e.g. owls. Risks of attracting predators by calling (or moving) more during bright moon may be offset by primates' visual ability to detect them. Moonlight effects should be studied in more nocturnal primate species.

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Beyond endocranial capacity and indices: A new multivariate approach to quantify endocranial variability.

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Usually, endocasts are characterized qualitatively by the appearance of particular anatomical traits and quantitatively by the endocranial capacity, a handful distance measurements and related indices. Here we present a multivariate approach to obtain much more quantitative information of the endocranial morphology using geometric morphometrics.

For this purpose a new endocranial landmark set composed of 15 landmarks and 300 semilandmarks is established. Ridge curves are measured on the midsagittal profile, the clivus, the foramen magnum, the transverse and sigmoid sinus, the petrous crest and the lesser wing of the sphenoid. The calvarial and cerebellar surface are captured by surface-semilandmarks. Differences in shape and size are analyzed in shape and size-shape space. Reliability of the landmark set is shown by comparisons of repeated measurements.

We demonstrate this approach in a study of the evolutionary change of ontogenetic patterns. Three-dimensional coordinates of the newly established landmark set are measured on CT scans of *Homo sapiens* and *Pan troglodytes* at different ages, and two *Australopithecus africanus* specimens, Sts5 and Taung. The Taung specimen is mirror-imaged and missing parts are estimated by reference-based reconstruction using thin-plate-spline-warping. A principal component analysis of Procrustes coordinates shows that the ontogenetic trajectories of humans, chimpanzees and australopithecines diverge in a way familiar from published results relying on ectocranial data.

The methodology employed here provides a coherent framework for the analysis of shape and size of endocranial morphology with more geometric information than can be captured by distance measurements and offers the possibility of visualizing and thus localizing shape differences.

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Assessing the reliability of analysis of partial and fragmentary cranial remains.

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The Matjes River collection is an extensive series of Holocene skeletal remains that have been used in several studies although some of the original information on the cranial remains has been lost. The fragmentary and partial crania from this site, have been analysed to determine sex and population affiliations. Modern South African populations from the Dart collection are used as comparatives to determine sex and population affiliations. This study endeavours to assess the validity of information obtained from the partial and fragmentary crania of this collection. The results based on only a few measurements are tested to determine the accuracy of the discriminant analysis findings. This is not a case of eliminating variables by stepwise discriminant analysis. It is a case of opportunistically selecting variables that tend to survive in fragmentary material. The results show that from even a single bone of the cranial vault, e.g. a parietal, sex and population affiliation can be ascertained to approximately 65% accuracy, using only three measurements. Limiting the possible outcomes, i.e. by performing discriminant analyses with only two possible results (SA Negro/Khoisan, Bushman/Hottentot) increases the rate of correct identification from 20% to 60% on very fragmentary remains. This result is consistent over various combinations of populations and makes very little difference to the reliability of results. Thus using discriminant analysis on even very fragmentary material can yield valuable information about an assemblage of crania, and while not as reliable as information from complete crania, can broaden our understanding of ancient populations.

Early human skeletal remains from Sabana de Bogotá, Colombia, South America: Implications for the settlement of the New World.

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Since the investigations of Neves and Pucciarelli (1989,1990,1991) in South America and Steele and Powell (1992,1994) in North America, the comparative study of cranial morphology of human skeletons of the first Americans has finally participated, in modern times, in the debate on the settlement of the New World. Human skeletal remains of the first Americans are scarce, mainly in North America. In South America the situation is less dramatic. Two important archaeological regions have generated important collections that allow for an in depth analysis of the cranial morphological variation of the early Americans: Lagoa Santa, Brazil, and Sabana de Bogotá, Colombia. Human crania from the former have been extensive studied by one of us (WAN) and collaborators over the last 17 years. These studies have shown that the cranial morphology of the first South Americans was very different from that prevailing today in East Asia and among Native Americans. These unexpected results have allowed for suggesting, among other things, that the New World may have been colonized by two very different biological populations in the final Pleistocene/early Holocene. In this study, 17 human skulls dated to between 10 and 6 kyr, recovered in 4 different sites of Sabana de Bogotá, Colombia, were compared to the world cranial variation by two different multivariate techniques: Principal Components Analysis and Mahalanobis´ Distance. Both techniques generated similar results: the early Colombians show remarkable similarities with those from Lagoa Santa, as well as strong morphological affinities with present Australo-Melanesians and Africans.

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Multiple, novel polymorphisms in the rhesus macaque (*Macaca mulatta*) DRD4 promoter are associated with impulsive behavior.

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The human DRD4 gene contains numerous polymorphisms, including a functional 48bp VNTR in Exon 3 that is associated with impulsivity related behavioral phenotypes (e.g. novelty seeking, ADHD). The VNTR is present in many non-human primate species, but in rhesus macaques is invariant. We are screening the rhesus DRD4 gene (rhDRD4) for novel variants, and here we present evidence for an association between impulsive behavior and promoter region haplotypes. We sequenced 1.7kb of the rhDRD4 promoter using a screening panel of 24 subjects (12m, 12f) selected from a pool of 213 assessed for impulsivity using an intruder challenge test. To date, we have identified 8 SNPs within the promoter region, and a 32 bp insertion/deletion near the putative translation start site. Based on 48 chromosomes, the SNPs form two major haplotypes (A&B), and exhibit high LD (.76) with the in/del. In impulsive subjects, the frequency of haplotype B was .66 ($p < .01$) and the frequency of the deletion was .75 ($p < .001$). Like the human DRD4 promoter, the rhDRD4 promoter is highly polymorphic, rich in CpG dinucleotides, contains numerous Sp1 sites, and lacks TATA and CAAT boxes. Several SNPs occur in Sp1 and CpG sites, and thus may be of functional significance. Our association analysis, while preliminary, suggests a role for rhDRD4 in influencing interindividual differences in impulsive behavior, and lends support to a potential functional role for the promoter variants. Finally, our work emphasizes the value of cross-species comparative analysis of functional gene regions.

Identifying the most informative regions of the mitochondrial genome using phylogenetic analysis.

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Complete mitochondrial genome sequencing has become increasingly common in human genetic studies, although cost constraints limit many studies to the small mitochondrial control region. The goal of our study was to identify informative regions of the mitochondrial genome using two criteria: resolution of a phylogeny and reduced variances for estimates of time to most recent common ancestor (TMRCA). We started with a dataset of densely sampled members of macrohaplogroup N (Palanichamy et al. 2004) in order to maximize the number of resolvable branch tips in the phylogenies. We generated a series of datasets in which the complete mitochondrial coding sequence was systematically reduced by deleting major genes, starting from both ends of the control region. These datasets were used to generate Bayesian phylogenies in which the topologies were compared based on the Approximately Unbiased test (Shimodaira 2002). We used phylogenetic and coalescent methods to estimate the TMRCA of defined clades across all phylogenies.

Visual inspection of the phylogenies suggests that the second half of the mitochondrial genome may contribute disproportionately to the resolution of the phylogeny, including two approximately defined areas encompassing ATPase6 to ND3 as well as ND4 to the start of the control region. Phylogenies based exclusively on control region sequences were extremely poorly resolved, e.g. 1/3 sequences formed a single polytomy. Preliminary dating results, based on phylogenetic methods, demonstrated a substantial increase in TMRCA variances associated with a 60% reduction in sequence length, again highlighting the

region between ATPase 6 and ND3 as highly informative.

Morphological and molecular measures of papionine diversity as standards for the interpretation of hominin diversity.

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We report early results from a comprehensive project that uses landmark morphometrics and superquadric modeling based on 3-D surface point coordinate mapping and visualization (Sommer et al. 2006, this meeting) to gauge morphological differences among papionine primates known to exchange genes among conventional species level taxa. Morphological findings are compared with genetic measures on the same populations.

Papionine biological diversity has received extensive study recently. Unlike recurrent taxonomic rearrangements of disjunct Linnaean categories, our investigations focus on comparisons of phenostructure and zygostructure (Jolly 1993) in order to test hypotheses concerning broader patterns of early hominin evolutionary continuity (Henneberg and Thackeray 1995, Henneberg 1997, Henneberg and de Miguel 2004, Eckhardt 2000).

Our primary data set comprises $\leq$66 measurement points on 1348 cranial specimens distributed among 42 nominal species and genera of papionine primates (with taxon sample sizes ranging from 1 to 88); data collection is continuing and being extended to elements of the postcranial skeleton. Given the large and expanding size of our data set, only selected findings are reported here.

For example, a maximum parsimony tree of mitochondrial COII (Disotell 1992) groups *Cercocebus* with *Mandrillus*, while *Lophocebus* is placed closer to the pairing of *Theropithecus* with *Papio*. However, a matrix of distances between cranial vault points normalized by geometric means shows that *Cercocebus* differs by $\geq$5% from *Mandrillus* in three times as many comparisons as *Cercocebus* differs from *Lophocebus*, and six times as many comparisons as *Lophocebus* in turn differs from *Mandrillus*. Clearly, morphometric differences can misrepresent genetic distances drastically.

Support for this investigation was provided by the Australian Research Council, the Pennsylvania State University College of Health and Human Development, and the Department of Kinesiology's Davis Fund for the Encouragement of Innovative Research.

The genetics of cardiovascular disease risk factors in American Indians and Alaska Natives: The Strong Heart and GOCADAN Studies.

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Cardiovascular disease (CVD) and its associated risk factors are accelerating rapidly in American Indians and Alaskan Eskimos. The Strong Heart Study (SHS) was begun in 1988 to investigate CVD risk in American Indians, and in 1996 a family study was initiated, to investigate genetic determinants of CVD and its risk factors. More than 1,200 members of extended families were recruited and examined at each of the three field centers in AZ, OK, and ND/SD. Similarly, the Genetics of Coronary Artery Disease in Alaska Natives (GOCADAN) study was initiated in 2000 to investigate the genetic determinants of CVD and its risk factors. More than 1,200 Eskimos from coastal villages in the Norton Sound region of Western Alaska were recruited and examined. In both studies, information was gathered on demographic, lifestyle, and medical variables, and traits related to CVD, diabetes, and obesity were assessed. Genome-wide linkage scans have been initiated and several chromosomal regions likely harboring genes influencing CVD have been identified. For example, a locus influencing LDL-C cholesterol was detected on chromosome 19q13.41 (LOD = 4.3) in the SHS. Similarly, a locus influencing HDL-C was detected on chromosome 19p13 (LOD = 3.9) in the GOCADAN study. In our ongoing work, we are attempting to identify the functional polymorphisms that are responsible for these linkage signals. These studies will pave the way for determining how genes exert their effects on disease susceptibility in American Indians and Alaskan Eskimos and how interactions between genes and environment differ among Native populations.

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Functional aspects of the ankle and foot during the locomotor and postural behaviors of bonobos, chimpanzees and gorillas: a focus on captive animals.

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While African apes are predominantly quadrupedal knuckle-walkers, the need to negotiate variable terrestrial and arboreal substrates allowed the development of a large positional repertoire as well as a complex anatomy. Studies on positional behavior have revealed differences between bonobos, chimpanzees, and gorillas; however kinematic studies of the joint movements at the ankle and foot have only recently become a focus. Here, focused observations on movements of the ankle and foot of captive African apes during daily locomotor and postural behaviors are used to further explore differences in joint activity.

Instantaneous focal animal sampling, with the help of digital recording equipment, was used to record the ankle and foot positions of African apes in three zoological parks, with complex substrates during routine behaviors. In total 12 bonobos, 7 chimpanzees, and 6 gorillas were followed, resulting in approximately 216 hours (72 hours per species) of study and 12,960 instantaneous samples (4,320 per species). Data was statistically analyzed using *chi-square* tests.

Preliminary results indicate that there are few differences in ankle and foot movements during locomotor behaviors. In contrast, there are marked differences during postures. Most notable is the extensive use of dorsiflexion by chimpanzees, whereas bonobos show higher incidents of plantar flexion, and gorilla ankles are frequently more perpendicular. In addition, during sitting postures, chimpanzees seem to place greater force on the ankle and foot than gorillas, while bonobos occupy intermediate ground. Better understanding of specific differences in joint use will aid in the understanding of ankle and foot morphology.

The biology of conquest: The effects of Inka imperialism in Chachapoya, Perú.

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This research focuses on examining the effects of Inka conquest on the population structure of subjugated groups. While the implementation of Inka administrative policies was variable depending upon a number of sociopolitical and economic factors, there were some broad commonalties. Inka imperialism often included compulsory urbanism and relocation of

indigenous populations. While obviously influencing regional political and economic infrastructure, these imperial institutions would have also affected population structure by altering established gene flow patterns and mating networks. Utilizing measures of genetic differentiation, biological distances, and determinant ratios, this research characterizes the biological effects of Inka conquest on the Chachapoya of northern Perú. Morphological data were generated from three pre-Inka skeletal samples (n = 246) and one Inka period sample (n = 13) in an attempt to characterize the biological effects of imperialism. Pre-Inka levels of regional phenotypic variation and biological distances suggest an isolation-by-distance population structure. Comparison to the Inka period sample suggests a reduction in phenotypic variance, though more Late Horizon samples will be needed in order to increase analytical power. The results are discussed in relation to evidence of imperialism from other regions conquered by the Inka.

A preliminary analysis of the mechanics, chemistry, and color of leaves ingested by four colobine species in Vietnam.

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It appears that all catarrhine primates can equally differentiate leaf color. However, it remains to be seen if leaf monkeys, particularly sympatric and congeneric species, select leaves that differ mechanically and chemically, and if these leaf characteristics are associated with certain spectrographic signatures. This study examines variation in the toughness, chemical composition, and color of leaves selected by four colobine species at the Endangered Primate Rescue Center (EPRC), Cuc Phuong National Park, Vietnam. The location of the EPRC permits us to provision the study species with a range of foods found in their natural habitat. The inclusion of *Pygathrix nemaeus, P. cinerea, Trachypithecus delacouri,* and *T, laotum hatinhensis* permit both intra- and intergeneric comparisons. By providing the primates with monospecific bundles of leaves we were able to rank the most preferred, moderately preferred, and least preferred foods. The toughness of all selected foods was found to be statistically comparable among the four study species. However, the species appear to partition their diets according to the percentage of protein and secondary chemical compounds found in selected leaves. Furthermore, the chemical make-up of the leaves is correlated with particular shades of green and red. We are presently augmenting these findings with data on dietary mechanics, chemistry and behavior in captivity and the wild.

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Towards a solution to the syphilis enigma: trend in the *arp* gene suggests evolutionary relationships of the treponemes.

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The origin of venereal syphilis has been a source of contention for historians, physicians, and physical anthropologists for the past century. Though the genome sequence of the causative agent of venereal syphilis, *Treponema pallidum* subsp. *pallidum*, has been determined, definite evolutionary relationships between *T. p.* subsp. *pallidum* and *T. p.* subsps. *pertenue* and *endemicum*, the spirochetes responsible for the non-venereal diseases yaws and endemic syphilis, have yet to be ascertained. We sequenced the repeat portion of the Acidic Repeat Protein (arp) gene from 15 *Treponema pallidum* strains and have discovered a marked trend between the venereal and non-venereal forms. Although the gene can be comprised of 1 to 14 sixty basepair repeats, non-venereal syphilis strains have identical repeats while venereal syphilis strains have multiple repeat types. Sequence homology between the arp gene and fibronectin adhesins from gram-positive bacteria suggests this protein may similarly be involved in pathogenesis. The different types of repeats present in venereal syphilis strains may account for the bacteria's ability to bind to a range of cell types and result in a systemic infection unlike that of yaws and endemic syphilis. This is the first large-scale genetic difference between the subspecies and the only one suggesting functional differences. These results provide molecular evidence for the subspecies designations, argue that the agents of yaws and endemic syphilis are more closely related to each other, and proposes that syphilis is a more recently emerged variant.

Vertebral border shifts in two pre-Iñupiat groups from Pt. Hope, Alaska.

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In recent years, vertebral border shifts (VBS) in fossil hominins have received considerable attention. VBS and the concomitant change in the number of thoracic and/or lumbar vertebrae are also seen in low frequencies in the general population of modern humans. Research reveals that cranial shifts predominate in low latitude groups, while caudal shifts characterize high latitude groups. This suggests VBS may be associated with eco-geographical patterning in trunk height.

In order to test the hypothesis that caudal shifts are seen in higher frequencies in high latitude groups, human skeletal remains from Pt. Hope, Alaska were examined. Pt. Hope is located on the northwest coast of Alaska, 150 miles above the Arctic Circle. Archaeological investigations of Ipiutak (2100-1500BP) and Tigara (800-300BP) cultural components yielded nearly 500 human burials. Both represent pre-Iñupiat foragers adapted to harsh Arctic environments. Of these, 126 individuals (males=65; females=61) with complete vertebral columns could be included in this study.

Results indicate that 26 individuals (21% of the total sample) exhibit VBS at the thoracolumbar border. Of these, 23 individuals possess caudal shifts. This high frequency of caudal shifts is consistent with the pattern found in the high latitude Sadlermiut Eskimo, and in marked contrast with the high frequency of cranial shifts documented in low latitude East African groups. These findings lend support to the hypothesis that the direction of VBS may be influenced by eco-geographical factors.

A comparison of microtomographic systems for the analysis of dental tissues.

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Modern microtomographic techniques facilitate accurate imaging and measurement of internal dental structures (e.g., surface area of the enamel-dentine junction), as well calculation of tissue volumes. Such non-destructive studies are becoming commonplace, and the accuracy of these techniques has been demonstrated for certain systems (e.g., conventional laboratory micro-computed tomography (MCT) and synchrotron MCT). Nonetheless, fundamental differences between microtomographic techniques have been shown to lead to differences in image quality, which may result in differences in measurements of volumes and surface areas. In order to explore this variation, we took identical measurements

on microtomographic images of a small sample of teeth that were scanned with different techniques, including laboratory MCT, industrial MCT, and synchrotron MCT. Results indicate that image quality differs between scanning systems, and factors such as the degree of mineralization (or diagenetic remineralization), absolute enamel thickness, and specimen size should be taken into account when choosing the most appropriate scanning technique. While image quality differs between systems (especially for fossil samples), measurements of the same teeth without strong remineralization scanned on different systems were comparable. Post-processing of data and image manipulation (tissue segmentation and image correction) requires more effort prior to recording measurements when using conventional laboratory MCT compared to synchrotron MCT, due to the greater incidence of scanning artifacts caused by conventional polychromatic cone X-ray beams. Combining measurements of teeth taken on different types of microtomographic systems presupposes that the accuracy of each system is approximately equal, and the research presented here indicates that this is often the case.

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A health assessment of the Curripaco people in Amazonas State, Venezuela.

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The state of indigenous health in Venezuela is a key political interest as nationally-funded programs such as Barrio Adentro, the Cuban-run healthcare initiative, are under constant public scrutiny. Researchers conducted a cross sectional health survey of the Curripaco people, an indigenous group who collectivley reside throughout Amazonas State, during the summer of 2005. The purpose of this study is to assess the current health state of indigenous peoples in Venezuela, and the infrastructure of the public health services offered to these groups. The Curripaco peoples' perception of their health was documented through a verbally administered health questionnaire in the rural settlements of La Esperanza, Pavóni and Saron. The survey, targeted at households that included someone who spoke or understood Curripaco, focused on diet and nutrition, morbidity and mortality, immunizations, prenatal and dental care and access to medical treatment. Vital statistics were also recorded for survey respondents. The perception data was then correlated with local and national clinical statistics, where available. Results indicate discrepancies between the Curripaco's perceived morbidities and actual clinical statistics, as well as a lack of knowledge about healthcare services offered in their area. The results of this study are intended to be presented in a publication distributed to physicans working with indigenous populations, by the Venezuelan Ministry of Health.

The authors would like to thank the Venezuelan Ministry of Health for making this research possible.

Age/sex class differences in foraging on *Acacia*-dwelling ants by white-faced capuchins (*Cebus capucinus*).

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Feeding on *Acacia*-dwelling ants by white-faced capuchins (*Cebus capucinus*) is similar in some respects to termite-fishing by chimpanzees. Both food sources are predictable in time and space and presumably meet similar dietary needs, but also present formidable foraging challenges. The ants' aggressive response to disturbance of their host plant may favor the development of specific predation skills or strategies. We present data on *Acacia* ant foraging by wild capuchins, discuss observed differences between groups and age/sex classes, and note similarities with termite-fishing by chimpanzees.

We conducted observations on two neighboring groups in Santa Rosa National Park, Costa Rica, in 2001. We found significant differences in the rate of feeding bouts between groups. Juveniles engaged in feeding bouts at higher rates than other age/sex classes and also had the highest percentage of failed attempts. We identified several feeding methods but a preference towards single, detached branch thorns. We noted an aggressive response by the ant colony more frequently when subjects were feeding on thorns that were detached from the plant rather than left attached, though it was unclear whether this was a cause or effect of the method used.

As in termite-fishing chimpanzee populations, neighboring capuchin groups engaged in *Acacia* ant feeding at different rates despite living in similar habitat, and the behavior was less frequently observed in adult males. Adults were more skilled than younger individuals. We hypothesize that capuchins require several years to achieve proficiency, and that different foraging patterns of adult males and females reflect divergent foraging strategies.

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Spatial variation in the activity and positional behavior of *Ateles geoffroyi ornatus* and its relationship to forest disturbance at Estación Biológica La Suerte, Costa Rica.

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Large body size, diet of ripe fruit, and large home range size may make spider monkeys particularly vulnerable to habitat disturbance. Whether this is due to their restrictive diet or to a forest's maturity and structure is debated. To explore how disturbance level and forest structure impacts positional behavior, activity, and range utilization of spider monkeys, a single community of *Ateles geoffroyi ornatus* was observed in both selectively logged and unlogged forests. Qualitatively assessed disturbance levels differed significantly between forests. However, as disturbance level increased structural differences were observed only in decreased inter-tree spacing of trees and decreased liana load and were not different in other forest structure measures. Analyses of ASTER satellite data show a homogenous forest canopy across both forests. Positional behavior did not differ between the forests. Activity budgets differ both by sex and between the two forests. Males rest more than females, while females feed and forage more. As a percentage of time spent in each forest, spider monkeys travel in the logged forest more often and rest less than they do in the unlogged forest. Feeding and foraging is unaffected. This suggests that highly disturbed areas do not act as core range areas of *A. g. ornatus*. Individuals may use logged forests primarily as corridors to less disturbed areas. Thus, selective timber extraction in Costa Rican forests may not severely affect spider monkeys if a contiguous refuge area remains and if logging is executed in a sustainable manner that does not significantly alter forest structure.

Sources of mechanical work and power for walking *versus* running in ring-tailed lemurs.

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Most quadrupedal animals, including primates, increase their energetic cost of locomotion as they increase speed. Many animals use energy-saving mechanisms including energy storage in tendons to offset some of that cost. However, primates are known to have limb muscles with short, stiff tendons with a limited

capacity for strain energy storage. How primates balance power production and energetic cost as speed increases is therefore unclear. This study begins to address this question by evaluating how muscle mechanical advantage, limb joint work and power requirements change across gaits and speed in primates.

Four adult ring-tailed lemurs, *Lemur catta* (2 males, 2 females; 2.2 to 2.8kg body mass), were studied at the Duke University Primate Center. Animals were trained to walk and run along a 12m x 1m runway constructed along a level stretch of outdoor paddock. The runway was instrumented with a 0.6m x 0.4m force platform; animals were video recorded in 2D using a high-speed (250 Hz) digital camera. Inverse dynamics was used to calculate the net ground reaction force and limb inertia based moments, instantaneous power (W) and total work (Jkg^{-1}) at each limb joint.

Initial results suggest that the mechanical work and power produced at the distal limb joints account for much of the change in whole limb work with speed, allowing lemurs to recruit their shorter muscle fibers for increasing velocity. These data represent a first step in understanding how an animal designed for maximizing net power output maintains a reasonable locomotor economy for walking and running.

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To grasp or not to grasp? Structure and function of platyrrhine caudal vertebrae.

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The prehensile tail may have evolved twice in NW monkeys (Napier, 1976; Rosenberger, 1983), suggesting it is an effective adaptive strategy for negotiating arboreal habitats. However, little is known about the mechanical structure of primate tails, or even how prehensile and nonprehensile tails differ. Previous study has shown that external measurements of caudal vertebrae can distinguish prehensile from nonprehensile tails within the vertebral sequence, but only distally, not proximally (German, 1982). This study examines the structural properties of prehensile and nonprehensile caudal vertebrae using pQCT, to test the hypothesis that prehensile tail caudal vertebrae are stronger and more rigid in bending/torsion than homologous vertebrae in nonprehensile tails, and to examine the possibility that proximodistal location along the vertebral sequence influences vertebral structure differently between tail types.

The three regions of the tail were examined for differences in prehensile-tailed *Alouatta* and *Cebus*, and nonprehensile-tailed *Pithecia* using homologous vertebrae. Vertebral cross-sectional properties were regressed against vertebral length and equivalent structural properties of limb bones using RMA. Caudal vertebral strengths/rigidities are isometrically scaled in each taxon ($p>0.05$). Elevations of species-specific RMA lines are different in the proximal tail region ($p<0.01$), where *Alouatta* is stronger and more rigid than both *Cebus* and *Pithecia*, and *Cebus* is stronger and more rigid than *Pithecia*. However, the two prehensile-tailed taxa do not have different RMA elevations in any other tail region, and both are stronger and more rigid that *Pithecia*. These results suggest that finer distinctions can be made among the tails of prehensile-tailed taxa if internal structural data are examined.

Moment arm of the triceps brachii and habitual forelimb position in primates.

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Habitual forelimb posture varies with locomotor behavior in primates and other mammals. Typically, arboreal quadrupeds employ flexed forelimb postures that lower the center of gravity, aiding in balance on small supports, while humans often use flexed elbow positions during manipulative tasks. In contrast, terrestrial quadrupeds walk with more extended forelimbs to mitigate high bending moments resulting from higher substrate reaction forces. Non-human hominoids also use extended elbows during quadrupedality and below branch suspension. Generally, primates that use more extended forelimb postures have dorsally angled olecranon processes. This morphology is assumed to result in peak moment arms (MA) of the triceps brachii (TB) at more extended elbow angles, providing maximum mechanical advantage at the habitual position—a model of TB function that has been used to reconstruct locomotor and manipulative capabilities in fossil taxa.

We test this model of TB function using a tendon excursion method to measure its MA in primate cadavers of several different lineages and locomotor modes. The MA is calculated as the first derivative of the tendon excursion versus joint angle curve, allowing measurement throughout the range of motion. Our results mostly support the model, with the maximum MAs of the terrestrial quadrupeds and large-bodied apes generally occurring at more extended joint angles than those of the arboreal quadrupeds, gibbons and humans. As suggested by other researchers, gibbons might not follow the large-bodied hominoid pattern because during brachiation the TB is contracted to extend the elbow from flexion at the ends of the swing and support phases.

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First evidence for ecological risks among juvenile Phayre's leaf monkeys.

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The juvenile risks hypothesis assumes that juveniles lack ecological competence for optimal predator avoidance and foraging, leading to increased risks of mortality. To investigate these ideas a pilot study was conducted on wild Phayre's leaf monkeys (*Trachypithecus phayrei*) at Phu Khieo Wildlife Sanctuary, Thailand. We predicted that if juveniles are less efficient foragers, they should: 1) dedicate more time to feeding and foraging than adults, and/or 2) rely more on 'easy' food items. If their predation risk is greater, juveniles should use tree heights at the highest or lowest levels less often than adults. Activity data were collected on all individuals from two habituated groups (12 juveniles, 14 adults; May-November 2004) using scan sampling. Juvenile and adult activity budget, diet and height were compared using Wilcoxon's signed ranks test with months as blocks to control for seasonal variation. Juveniles fed at a greater rate than adults ($P<0.05$) and relied more heavily on leaves in their diet ($P<0.05$), while adults ate fruit and flowers more often. These differences might be attributed to feeding competition as well as to the possibility that leaves are easier for inexperienced juveniles to find and eat. In contrast to predictions about predation avoidance, juveniles did not use forest levels differently than adults. However, this result is not unexpected if feeding competition forces juveniles to utilize more vulnerable spatial locations despite potential risks. Results suggesting age differences in foraging efficiency also may provide support for the hypothesis that juveniles need time to learn ecological skills.

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Northern Arctic population structure, history, and migrations in light of new data and methods.

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Since 1916, physical anthropologists have been analyzing skeletal measurements from the North American Arctic to ascertain interrelationships among ancient and modern populations. The analyses have become more sophisticated due to advances in anthropology, statistics, population genetics, and computers. Statistical advances include multivariate methods, clustering algorithms, and the application of population genetics models to quantitative traits. New analyses of craniometric variation in over 600 individuals from northern Alaska, Hudson Bay, Greenland, Baffin Island, and Labrador, are remarkably in agreement with a recent reassessment (Hollinger et al. 2004) of archaeological evidence for the Thule migration and molecular results showing mitochondrial haplogroup monomorphism among Greenland Eskimos (Saillard et al. 2000).

Craniometric data were carefully examined for outliers and interobserver differences. Despite quite different collection methods only one measurement of 19 showed a significant difference. The craniometric results reveal strong regional patterning with the notable exception of Birnirk culture groups from Barrow, Alaska, and later Greenland groups, providing evidence of a Birnirk source for the Thule migration of peoples eastward (900 to 1300 AD). The Birnirk culture, which spanned the northern Bering Strait for centuries, shows remarkable Alaskan within-site diversity, and has far greater within-group heterogeneity than the other groups in this study. In contrast, the Greenland groups (from three eastern and western coastal sites), and a Labrador group, most of which are separated by thousands of miles, show great homogeneity and similarity. Hudson Bay groups cluster together and are morphologically, as well as geographically, intermediate between the Greenland and Alaskan groups.

Resource defense and pair-bonding in red-bellied lemurs (*Eulemur rubriventer*) in southeastern Madagascar.

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Small, pair-bonded groups are common among Malagasy lemurs and Fuentes (2002) hypothesized that pair-bonding in this case may arise from the need for resource defense. To test this hypothesis, we analyzed 14 months of social data from three wild groups of red-bellied lemur (*Eulemur rubriventer*) and evaluated the following predictions: 1) small, pair-bonded groups occur most often, 2) affiliative behaviors occur most often between the adult male and female, both members will bear equal responsibility maintaining affiliation, 3) males and females will attack non-group members, 4) within-group contest for food is minimal (i.e. low agonistic rates), and 5) between group contest competition for food will be more common. It was also expected that social patterns would vary with food availability given unpredictable phenological patterns observed in southeastern Madagascar.

Groups consistently maintained a one adult male and female configuration. Males, females, and offspring were equally likely to be each other's nearest neighbor and were equally likely to initiate grooming bouts. Individuals were more likely to be without a nearest neighbor ($p < .001$) and groomed less during food scarcity ($p < .0001$). As predicted, both males and females defended food from conspecifics. Within group agonistic rates were low (.02/hour) and did not occur in a feeding context. Red-bellied lemurs primarily encountered rufous lemurs (*Eulemur fulvus rufus*) in food trees (n=54) but were consistently displaced (n = 46) except during food scarcity periods (n = 8).

Sub-arctic Hokkaido: trends in oral and physiological health from the Jomon through Okhotsk periods.

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The dental and cranial remains of 99 individuals recovered from archaeological sites in Hokkaido, Japan, were assessed for physiological stress and oral pathology. Of these individuals, 60 span the middle (4000-1000 BC) to epi-Jomon (300BC-700AD) period while 39 represent the Okhotsk (500-900AD) culture period. The aim of this research was to develop general and specifically oral health profiles for these samples. Results are compared with other prehistoric Asian samples and also published data on prehistoric peoples living in similar ecological and behavioral conditions: pre and proto historic Eskimos and Aleuts.

Specifically, results indicated that the frequency of cribra orbitalia was similar between the Okhotsk and Jomon samples (and also northern Vietnam) and higher than that seen in North American subarctic samples (and also samples from Thailand). Linear enamel hypoplasia was comparable among the Hokkaidan samples, much higher than seen in Aleut samples, but lower than in Southeast Asia in general.

Hokkaido is unique in East Asia in forming one of few extreme environments to which prehistoric peoples adapted and thrived. Discussion will focus on the observation that an understanding of the health of such communities will assist in our appreciation of how they accomplished this feat and what biological costs or benefits they encountered as a result.

Intrinsic and extrinsic factors predicting extinction risk at a fine taxonomic scale: The case of the colobine monkeys.

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There is mounting evidence that current species extinctions are non-random. Some taxa appear to possess traits that increase their risk of extinction. Previous analyses examining factors related to extinction risk often included several orders of animals which may produce confounding effects due to the wide array of taxa considered. Notwithstanding, patterns of extinction risk are evident from these broad scale analyses. It is unclear, however, whether these same patterns of extinction risk will be observed at a finer-grained taxonomic scale. Therefore, in this study, the relationship between several intrinsic and extrinsic variables and extinction risk was investigated in a single subfamily, the colobinae.

Colobines are often characterized as medium-sized, folivorous monkeys. Nonetheless, there is a fair degree of ecological diversity within the subfamily. There is also variation concerning conservation status, with over one half of the colobines threatened with extinction.

Data for over 25 colobine species were collected from the literature. Twelve predictor variables and three measures of extinction risk were employed in backwards stepwise multiple regressions using independent contrasts. The results showed that intrinsic factors such as the degree of folivory, group size, and ecological flexibility were negatively correlated with extinction risk while an extrinsic factor, local human population density, was positively correlated with extinction risk.

These results largely corroborate previous studies, yet there are also new findings. Body mass was not found to be a significant predictor, while the degree of folivory was correlated with extinction risk.

Mortality considered as a proxy measure of morbidity.

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Information on mortality, whether gleaned from skeletal remains, grave markers or archival documents, is one of

the foundations for assessing health in past populations. Levels of morbidity are often inferred from mortality estimates, yet many anthropologists are unsure of the validity of this. The absence of research in this area is due to several deficiencies: difficulty in assessing morbidity from hard tissues, paucity of reliable archival morbidity data and problems inherent in the study of none-fatal measures of health. This paper considers issues pertinent to the question of using mortality as a proxy measure for morbidity. It uses the investigation of morbidity and mortality records for British soldiers for a 70-year period in the 19th century. It concludes that, for some specific illnesses and categories of diseases, there are dependable relationships between morbidity and mortality, but for many diseases and conditions the relationship is erratic.

A consumer's perspective of genetic ancestry testing.

G. Paige, African Ancestry, Inc.

Consumers are embracing genetic technology as a tool to help identify their ancestries. There is a great deal of variation in the type of consumer, the motivations for testing, and the reactions to the results. This presentation will examine these factors as well as the concerns that people have about the process.

Nutritional deficiencies in the 14th century Northern Rio Grande.

A.M. Palkovich. Krasnow Institute at George Mason University.

Recent re-analyses of a variety of prehistoric skeletal series have revealed a range of osseous pathologies not previously recognized. Iron deficiency anemia attributed to maize dependent diets was originally implicated as the primary source of skeletal pathologies at Arroyo Hondo Pueblo. Reanalysis of this skeletal series has recently identified the prevalence of rickets at this site (Palkovich, 2005). Differential diagnosis now also indicates the presence of scurvy among sub-adults at the site. This study presents information about the spatio-temporal distribution of these synergistic nutritional deficiencies at the site. It appears that childrearing practices and seasonal food shortages were likely responsible for the observed morbidity and mortality patterns. In addition, onset of rachitic disabilities in infancy had significant implications for the viability of some segments of the Arroyo Hondo adult population.

Multiple mating and female mate choice in *Lemur catta*: does it pay to be a dominant male?

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Many female primates copulate with multiple males when fertile. In one such species, the ringtailed lemur (*Lemur catta*), females have short estrus periods which rarely overlap with other same-group females, creating the possibility for a single high-ranking male to monopolize matings. Despite this, multiple mating is the norm for this species. This study's aims were therefore to quantify levels of promiscuity among female *L. catta*, and identify whether high-ranking males are more reproductively successful than subordinates. Data were collected on free-ranging *L. catta* on St. Catherine's Island, USA across five breeding seasons. Four groups were studied, each having 4-8 females, and 2-4 non-natal males. A selectivity index (representing the proportion of group males mated) was calculated for each female. Male dominance ranks were calculated using pre-breeding season agonistic data. For all mating females (n=40), the mean selectivity index was 62.7±29.2%. Among females whose entire estrus period was observed (n=6), multiple mating was even more pronounced; these females mated with 90.3±15.2% of group males. However, an analysis of mating order shows that alpha males were significantly more likely to ejaculate with females earlier in the cue than subordinates (Mann-Whitney: p=.011). Additionally, alpha males were the first to ejaculate in 70% of cases in which the onset of estrus was observed and the first ejaculating male was known (n=10). In conclusion, though female *L. catta* mate multiply, high-ranking males may have higher reproductive success than subordinates if a first-mate fertilization advantage exists. Paternity analyses are currently in progress to evaluate this hypothesis.

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The sore price of piety: osteological evidence of kneeling in a monastic community.

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It is often argued that bone modifications make it possible to infer activity or posture by examining the skeleton. To test this, two skeletal samples were examined from historic (12th-16th Century) British monastic collections. The samples consisted of 180 male skeletons from Merton Priory, Surrey, England (an Augustinian community at which monks prayed kneeling) and 50 male skeletons from St Mary's, Stratford Langthorne, Essex, England (a Cistercian monastery at which monks prayed standing). These were examined for evidence of eight non-metric traits reported to result from a kneeling/squatting posture. The two samples were also examined for evidence of osteoarthritis (OA) of the knee.

A trait comparison revealed that 72.8% of the skeletons from Merton Priory and 73% of the skeletons from Langthorne exhibited one or more non-metric traits. Chi-square analysis showed no statistically significant trait differences between the two monastic sites. Inter-site comparisons showed similar OA incidence (53.7% of individuals at Merton Priory, and 59% at Langthorne were affected). A significant result was identified for the medial and lateral tibio-femoral compartments ($p<0.001$). This is potentially the result of different biomechanical forces acting on the knee in the two groups.

For these samples, non-metric traits and osteoarthritis cannot be used to infer a kneeling posture. Although these skeletal changes may be influenced by biomechanical forces, their aetiology is multifactorial, and therefore, alone they are not reliable indicators of lifestyle/occupational posture.

Hand postures reflect bone apparent density patterns in the primate distal radius.

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Primates utilize diverse hand postures during quadrupedal locomotion (e.g., knuckle-walking, digitigrady, and palmigrady) that are characterized by different degrees of dorsal-volar flexion. Hand postures also differ during climbing behaviors (e.g., differences in radio-ulnar deviation). These postures can influence wrist joint morphology differently. While studies have associated the *external* configuration of bony wrist elements with specific hand postures, fewer have investigated the *internal* morphology (e.g., material properties) of these bones. Because mineral density is directly proportional to bone compressive strength, load transmission through a joint surface can be estimated by characterizing local distribution of bone mineral in articular surfaces (i.e., the subchondral plate).

In this study, we assess subchondral bone density patterns of the distal radius in catarrhine primates. Using computed tomography osteoabsorptiometry (CT-OAM), contour maps of optical densities are constructed and superimposed onto virtual reconstructions of the distal radius. Maximum density areas are identi-

fied relative to dorsal-volar and medial-lateral reference planes and these are compared across groups exhibiting different hand postures.

Knuckle-walking apes have a greater volar concentration of high density in the articular surface, unlike digitigrade and palmigrade monkeys which have a greater dorsal concentration. Orangutans have a greater medial (ulnar) concentration of high density, while African apes have a greater lateral (radial) concentration. These results provide support for distinguishable loading regimes arising from different hand postures adopted by primates during quadrupedal locomotion and climbing behaviors. We suggest examining both the *external* and *internal* anatomy of the distal radius to better understand the functional morphology of the wrist joint.

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An investigation of the association between facial asymmetry and hand bone asymmetry in skeletal material.

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Exposure to sex hormones during gestation affects different aspects of development, and finger length asymmetry, commonly referred to as the 2D:4D ratio, differs between men and women. Men tend to have a lower 2D:4D ratio (the ring finger is longer than the index finger), but the 2D:4D ratio tends to be higher in women. Previous data suggests that higher prenatal testosterone levels cause a lower 2D:4D ratio whereas increased prenatal estrogen levels cause the opposite. Because the face and hands develop at the same time, facial asymmetry and hand bone asymmetry may be associated. This study aimed to examine the relationship of facial asymmetry and finger length asymmetry in skeletal material. A standardized asymmetry index was devised to assess asymmetry in 13 paired bilateral cranial landmarks as well as maximum finger length asymmetry and total articular finger length asymmetry. Asymmetry calculations were then statistically analyzed to show a correlation between facial asymmetry and finger length asymmetry.

Following analysis, two measurements were very highly significantly correlated in females, but just one measurement was significantly correlated in males. The trend that women exhibit longer index fingers than ring fingers was confirmed. However, unlike studies of living subjects, when skeletal material was examined, the index finger was longer than the ring finger in the majority of male specimens. Although there has been a large number of studies examining the 2D:4D ratio and its relationship with prenatal sex hormones and facial asymmetry, there is still no definitive evidence that these three variables are linked.

Skeletal response to total hip arthoplasty in skeletally mature individuals: the effects of stress shielding on bone mass and biomechanical integrity of the mid-shaft femur.

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Mechanostat theory postulates that changes in bone mass and strength are directly linked to loads imposed by mechanical stimuli. Surgical intervention can engender changes in the mechanical loading environment to which the mechanostat responds; total hip arthroplasty prostheses bear part of the postoperative load originally carried by bone. As a result, the reaction of bone tissue to total hip replacement operations is usually explained as an adaptive response to a significant alteration in the stress environment.

The purpose of this study is to examine the effect of total hip arthoplasty on parameters of bone mass and strength in mid-shaft femora. For analysis, contralateral femora were used as a control to represent the normal condition of in-vivo implanted femora. A comparative sample of individuals without hip prostheses was also included in the analysis. Bone mass and geometric properties of strength were quantified using image analysis software. Results showed a decrease in bone mass in femora with prostheses, primarily through bone loss at the medullary envelope; however, a concurrent increase was observed in total cross-sectional area, and parameters of bone strength, I_x, and J. No detectable differences were found between femora of individuals without prostheses. This indicates that the abrupt change in the mechanical loading environment engendered by the prosthetic implant may have lead to accelerated resorption and apposition. These results suggest that, even in skeletally mature individuals, bone mass may accrue relatively rapidly through periosteal apposition and serve as mechanical compensation for the reduction in mass resulting from endosteal resorption.

***Homo floresiensis*: New species, new questions, still no answers.**

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A new species of hominid called *Homo floresiensis* was described in 2004 and generated considerable controversy as it may represent a late pleistocene population with morphological characteristics different from modern humans. In this paper we discuss alternative possibilities for what these findings might be. There are several problems with the material as presented: only one individual is described (LB1) although the authors state that the site had several others; dates, age at death and sex of the material are controversial, and even the pattern of association with stone artifacts found in the cave is not clear. However, the most striking feature is the small cranial vault, with an inferred brain size of approximately 400 cm^3. One possible explanation for such small size is that the Flores population had shrunk as a result of insular dwarfing. Another hypothesis is that the individual described was pathologic, suffering from a case of microcephaly. A recent work using 3DCT concluded that LB1 is not microcephalic and has brain features resembling *Homo erectus*. Nevertheless, this comparison included only one microcephalic of European origin. Unfortunately, since then LB1 has been severely damaged creating serious difficulties for future analysis. Considering the known plasticity of the skull, and based on the medical literature, which reports dozens of pathologies associated with microcephaly, with varying genetic and environmental origins and different morpho-physiological presentations, we suggest that there is still not enough evidence to discard the possibility that the fossil described is a pathologic hominid rather than a new species.

Significance of amylase gene duplications in human and non-human primate evolution.

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Amylase is the digestive enzyme responsible for starch hydrolysis. In ancestral primates, only one amylase gene was expressed in the pancreas, but subsequent duplications and a tissue expressivity change led to three functional amylase genes in apes, two expressed in the pancreas and one in saliva. In humans, there have been additional salivary gene duplications, and most humans have three copies, though copy number variation is common. Previous studies have shown

that the level of salivary amylase expression is 6-8 times greater in humans than in chimpanzees. If additional gene copies led to increased salivary amylase expression, then the human-lineage gene duplications may have conferred a selective advantage by facilitating more efficient digestion of high-starch foods, hypothesized to have been a key resource during hominin evolution. We used quantitative PCR to determine salivary amylase gene copy number in multiple human populations and in chimpanzees. In one human population we also measured salivary amylase expression to determine the relationship between copy number and expression. While we observed widespread variation in copy number across human populations, all chimpanzee individuals had a single gene copy. We also obtained amylase gene sequences across a panel of primate species to study the evolutionary history of this gene family and to estimate timing of duplication events. Interestingly, both of the chimpanzee pancreatic amylase genes have frameshift coding region mutations, which disrupt a protein structure that is otherwise conserved across mammals. These mutations may reflect the relative unimportance of high-starch foods in the chimpanzee diet.

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Geometric morphometry, missing values, and multiple imputations.

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In morphometric studies of human skeletal material, the problem of missing values is inevitable. Traditionally, missing values have been treated by leaving out incomplete individuals, or by obtaining single estimates for the missing values, and analysing the completed data as if they were genuinely complete. Both procedures potentially lead to biased inference. Recently, proper methods for handling missing values have been developed, one method being multiple imputation, where the missing values are estimated, e.g., 5 times with a stochastic element. This leads to, e.g., 5 slightly different completed datasets that are analysed taking into account the uncertainty in estimating the missing values. Based on some assumptions, this leads to proper inference.

Here, we show results of the application of multiple imputations to a dataset consisting of 9 2D craniometric landmarks on 53 complete crania (26 male, 27 female) from Africa (courtesy John M. Lynch). In order to evaluate the efficiency of multiple imputations, we randomly generated 5% and 10% missing landmarks respectively in two artificially incomplete datasets. Then we compared the results from complete data analysis to results from analysis of the artifically incomplete datasets. Two types of analysis, Procrustes superimposition and thin plate spline, were employed. Analyses were performed using the freeware programme R. The comparison showed that multiple imputation gives acceptable results in geometric morphometry. However, we also present some reservations concerning the methodology.

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Morphometric distinctions in the cranial bases of *Pan troglodytes* and *Pan paniscus*.

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Morphometric data for 31 basicranial landmarks were collected on roughly sex-balanced adult samples of *Pan paniscus* (bonobos) and all three commonly-accepted subspecies of *Pan troglodytes* (common chimpanzees), and then subjected to Procrustes superimposition and principal components analysis.

Preliminary analyses indicate that this approach yields reliable species-level distinctions. For example, the bonobos and chimps examined exhibit no overlap in their respective centroid sizes, nor in PC scores for the first principal component. (Following Procrustes superimposition, all principal components reflect shape differences.) Within *Pan troglodytes*, the western subspecies (*P. t. verus*) appears to exhibit the greatest separation from the others on PC1. An ANOVA test indicated no significant differences between the three subspecies' mean centroid sizes, but all were significantly larger than bonobos.

Interestingly, however, allometry appears to play little or no role in adult basicranial variation within bonobos or any of the common chimp subspecies. There does not appear to be any bivariate or multivariate relationship between centroid size and any of the first ten principal components, which together account for over 65% of the observed shape variation.

The apparent absence of allometric effects in adult *Pan* basicrania has implications for paleontological studies focused on the basicranium. It may not be necessary to consider size as a factor when investigating the taxonomic or phylogenetic importance of morphometric basicranial distinctions in the adult chimpanzee.

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The medieval climatic anomaly and its impact on health in the Pacific Rim: A case study from Canyon Oaks, California.

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Paleoclimatological analyses of western North America reveal a prolonged period of extreme drought from approximately AD 800-1350, termed the Medieval Climatic Anomaly (MCA). The purpose of this study is to test the hypothesis that the MCA resulted in increased resource stress and decline in health in a setting of north-central California.

Data were collected on the remains of a temporal series (n=98) from the Canyon Oaks site in Pleasanton, California. The analysis focuses on stature, linear enamel hypoplasias, dental caries, and skeletal evidence of violence in order to document and interpret temporal patterns of growth stress, oral health, diet, and interpersonal violence.

Statistical treatment reveals little diachronic change in occurrence of linear enamel hypoplasias, stature, or interpersonal violence. However, prevalence of dental caries shows statistically significant temporal and sexual differences (chi-square; $p<0.05$). Specifically, males show a decrease in carious lesions, whereas females show an increase, mostly in posterior teeth. These trends indicate a divergence in subsistence between males and females. In particular, females became increasingly reliant on cariogenic terrestrial resources such as acorns; whereas, males focused on marine resources such as shellfish and fish.

These results suggest a substantive shift in diet, without change in growth stress or interpersonal violence during the MCA. This pattern contrasts with other prehistoric populations from southern California (Santa Barbara Channel Islands region) where health declines are well documented during the MCA. At least for this setting, populations were able to mitigate stress, perhaps through social and cultural means of buffering negative environmental circumstances. These findings also reveal the complexity of stress as it relates to climate and the diversity of human responses, even within the restricted geographic setting of central and southern California.

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Discriminant function for sex determination in talus and calcaneous for Mexican population.

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The purpose of this study is to present the discriminant analysis of twenty metric variables from the talus and calcaneous of 113 individuals of known age and sex from

the Mexican skeletal collection housed at the Medical School of the National University of México. All of the bodies came from cadavers used in the dissection room of the Medical School of the National University, and all of them are from several hospitals and the Forensic Medical Service of Mexico City. All of the measurements were found to have significant differences by sex, and some measurements were different by side as well. It was possible to obtain more than 20 discriminant functions with one and two variables that minimally had 80% correct classification.

Reassessing *Osteitis deformans* (Paget's disease) in a pre-contact population at the Briarwoods site, Gulf Coast Florida.

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In 1980, J. Mitchem and S. Gluckman performed a salvage excavation at the Pre-Columbian Briarwoods site (8PA66), located in northern Pasco County, on Florida's Gulf Coast (Mitchem 1985). The site dates to A.D. 1000-1500. In 1982, Y. Işcan and J. Gomez found evidence of *Osteitis deformans* (*i.e.,* Paget's disease). Since Briarwoods is a Pre-Contact site, the presence of Paget's disease is unlikely because it is seen primarily in individuals of European descent (Barry 1969). As such, these findings are potentially very significant. Paget's is a generalized bone disease that produces a characteristic mosaic pattern visible through histologic analyses. This pattern is produced by increased osteoclastic and osteoblastic activity resulting from focally accelerated bone remodeling. Although the five skeletal elements used by Işcan and Gomez are from five different burials and are extremely fragmented as well as eroded, an histological analysis was performed to try to identify the histological mosaic pattern that is pathognomonic of Paget's disease. Our reassessment of the Briarwoods skeletal samples found no histological evidence that definitively supports the presence of Paget's disease.

Nutritional status of tropical horticulturists involved in the market economy in the lower Amazon, Brazil.

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The majority of inhabitants of the Amazon Basin are people of mixed ethnicity (Indigenous/Portuguese/African), referred to locally as Ribeirinhos. While most practice subsistence horticulture, Ribeirinhos also engage in other economic activities and are intimately linked to the national and global economies. Despite their large numbers and interesting position at the local-global intersection, very little data is available on their health and nutritional status. Data on height, weight, skinfolds and circumferences were collected using standardized procedures on a population of 469 rural Ribeirinhos (birth – 77 years) in the lower Amazon. The population showed a high degree of stunting. Average HAZ fell below –2.0 for all age groups over 3 years and 60% of adult males and 70% of adult females were considered stunted. Wasting was rare among children and adults. Average adult BMI's were above the US 25th percentile until age 50 after which both sexes showed a steady decline. Average upper-arm muscle area were above the U.S. 50th percentile for most age/sex groups. Twenty-six percent of adult males and 25% of adult females were considered overweight or obese and the highest rates of overweight/obese status were seen among 40-45 years olds for both sexes. Overweight and obese status was associated with household structure and shifts in subsistence strategies. For example, mature households with adolescent and adult children tended to have higher BMI values. Higher BMI values were also more common among men who participated in wage labor, especially timber extraction, but not necessarily among other members of their households.

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Canine size and bending strength in primates and carnivores.

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Past analyses demonstrate that carnivore canine bending strength is associated with killing behavior. While it is widely accepted that male primates have tall canine teeth in association with male competition, no study has evaluated canine bending strength in primates. Here, we test the hypotheses that male primate canines are weaker than female canines (because male canines are primarily used for display), and relative bending strength is associated with male competition. We employ carnivores as a baseline of comparison.

Male and female canine data for 114 anthropoids, 30 strepsirrhines, and 45 carnivores were obtained from the literature. We calculated canine bending strength using a beam model presented in van Valkenburgh and Ruff (1987). Several behavioral and demographic measures were used to quantify male competition. Independent contrast methods were used to evaluate allometric scaling of tooth size and strength versus body mass and skull length.

Surprisingly, male anthropoid primates are characterized as a group by canines that are relatively larger and at least as strong as those of carnivores. Anthropoids show strong positive allometry of canine strength, while strepsirrhines show isometry. Within any given species, male primates have canines that are as strong as or stronger than those of females in spite of the fact that they are considerably taller. These observations suggest that selection generally favors strong male canines. However, we find only weak support for the hypothesis that primate canine strength is associated with measures of male competition.

Articular and diaphyseal responses to loading in the femora of subadult mice.

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Phylogenetic relationships, body size, and physical activity patterns are frequently assessed from observations of skeletal elements. However, the regulation of bone and cartilage tissue growth by mechanical stresses is not fully understood. The accuracy of interpretations made from the skeleton is dependent upon our understanding of the physiological adaptation of bone and cartilage. We examined the effects of exercise on femoral growth in mice to test the hypothesis that increased mechanical loading leads to accelerated tissue proliferation in bone and articular cartilage.

The hypothesis was tested using 50 subadult mice of the strain C57BL6/J. The mice were divided into control and experimental groups of equal sizes. Mice in the experimental group had continuous voluntary access to an activity wheel. The housing and diet of both groups was similar in all other respects. Calcein was administered by intraperitoneal injections on days 8 and 22 of the 4-week experiment to label bone growth. Histological thin-sections through the midline of the femoral head and midshaft were compared between groups.

The results show that cartilage thickness, cartilage area, bone area, subchondral bone joint perimeter, and subchondral bone joint diameter were all significantly greater in the exercised group (P<0.05). Diaphyseal cross-sectional geometry and histomorphometric variables also differed significantly between groups (P<0.05). The exercised groups were 2%-7% larger on average for most variables. The results show that the articular region of the femur exhibited a greater osteogenic and chondrogenic response to loading than the diaphyseal region.

Stone tool marks on precontact human remains from Mangaia, Cook Islands: anthropophagy or bone tool production?

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Prehistoric human colonization of Oceania resulted in major landscape modification. In late prehistory, population growth led to dramatic resource scarcity resulting in dietary shifts to marginal resources, such as rat. This resource stress has been argued to have led to intertribal warfare and sometimes to cannibalism. Archaeological evidence of such practices comes from a series of rockshelter sites on Mangaia, Cook Islands that contain burnt and broken human remains in midden contexts; however, their interpretation has been hampered by the absence of tool marks indicative of butchery.

To further understand the meaning of these sites, we report the first evidence of stone tool marks on human remains from Mangaia. We micro- and macroscopically evaluate 1635 bones or bone fragments from a late prehistoric rockshelter site (MAN-84) that yielded abundant fragmentary human remains (MNI = 41) in and around traditional earth ovens. These remains and the limited material culture from MAN-84 differ from other habitation sites and from mortuary practices recognized in burial caves on Mangaia; suggesting that MAN-84 is a special-use site that may have included ritual or nutritive cannibalism similar to that predicted for periods of resource stress. Stone tool marks including cutmarks (slice, scrape, and chop) and percussion pits and striae are found on 36 of these. While some relate to areas of potential muscle removal or marrow extraction, a large number are found on fibulae – suggesting the possibility that bone tool blanks were being prepared at the site.

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Morphological integration during ontogeny of the mandible in living humans.

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Morphological integration has become an area of increasing research in physical anthropology. While most studies of integration have focused on the cranium, the mandible is a key component in skull morphology, mastication, and phylogenetic analyses. This project, therefore, uses ontogenetic mandibular radiographs of living humans (n=70) and conditional independence modeling to evaluate two questions. First, what is the pattern of integration at different developmental stages in living humans? Secondly, what differences, if any, occur in the pattern of integration during ontogeny?

While modern humans do not demonstrate a difference in the amount of integration during ontogeny, there is a significant shift in the pattern of integration. In juveniles, there exists a high degree of integration between the corpus and ramus, particularly involving the base of the corpus. In adults, the ramus becomes separated from the corpus; the anterior portion of the corpus undergoes the most dramatic shift, becoming highly modularized from the ramus. This decoupling of the corpus and ramus during growth is similar to what has been seen in the African apes and is likely due to differing functional needs of the two regions.

These results show that, as in the cranium, the pattern of morphological integration is not constant throughout ontogeny. Because the pattern of integration changes, likely due to dental growth in the corpus and musculature in the ramus (Daegling, 1996), small changes at different developmental stages could produce different adult morphologies and influence cranial development throughout hominin evolution.

Validation of the relationship between subchondral bone density and posture during locomotion.

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Functional morphologists have frequently sought to determine differences in habitual joint loading patterns and differences in posture based on gross morphological and osteological differences between extant, fossil and subfossil primates and especially hominin limb joints. The analysis of spatial patterns in subchondral bone density across convex joint surfaces is a relatively new and potentially powerful non-invasive tool for functional morphologists to use. This study provides an *in-vivo* experimental test of the relationship between patterns of subchondral bone density and joint posture in the knee joint. The hypothesis to be tested is that animals using more extended knee postures during locomotion should have more anteriorly located regions of maximum density on their articular surfaces than animals that use more flexed knee postures. To test the hypothesis, six sheep were exercised twice daily on motorized treadmills at moderate trotting speeds for a period of 45 days. Three were exercised on inclined treadmills (INCL) while the remainder used horizontal treadmills (HORZ). Differences in joint posture were measured using standard video-photogrammetric techniques and the INCL group were found to use more flexed knee postures (15°) than the HORZ group. Subchondral bone density was measured using CT scans and AMIRA 3D visualization software. While increased sample size is clearly required for more statistical power, preliminary results provided support for the hypothesis by demonstrating that the HORZ group had more anteriorly placed regions of maximum density than the INCL group. These results indicate that differences in habitual joint loading can be reconstructed from patterns of subchondral bone density.

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Locomotor Energetics and Ranging Ecology of Fossil Hominids.

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Previous researchers have suggested that locomotor energy efficiency was a driving selective force in hominid evolution, yet debate continues regarding hominid locomotor performance and its ecological relevance. To investigate these issues, I developed a biomechanical model linking limb design to the energy cost of locomotion (Pontzer, 2005. *J Exp Biol*) and validated the model empirically for a range of species including humans and chimpanzees. Using this model to estimate the energy cost of locomotion for different hominid species, I tested the hypothesis that locomotor cost in early *Homo* is significantly lower than in earlier hominids. Results suggest two grade-shifts in locomotor efficiency, with australopithecines more efficient than an ape-like ancestor, and *Homo* more efficient than earlier hominids.

To place these changes in locomotor energy cost into an ecological context, I then examined published estimates of day range, locomotor cost, and daily energy expenditure in 225 terrestrial mammals. Interspecific comparisons suggest selection for increased locomotor efficiency (i.e., lower energy cost of locomotion) is driven primarily by decreased habitat productivity and increased diet quality. These results are consistent with previous hypotheses suggesting the increased hindlimb length apparent in early *Homo* reflects an increase in diet quality and the invasion of drier habitats. Similarly, changes in habitat quality may have selected for increased locomotor efficiency in early hominids.

Habitat use and ranging behavior of *Callimico goeldii.*

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One group of *Callimico goeldii* was studied from September 2002 – August 2003 in northwestern Bolivia. Data were recorded using focal animal sampling at 5 minute intervals for a total of 1,375 observation hours. The *C. goeldii* diet consisted of fungi (38%), fruit (31%), arthropods (14%), and exudates (14%). Fungi and exudates were consumed principally in the dry season while fruits were consumed mostly in the wet season. The group concentrated its ranging activities in secondary forest (50%), primary forest with dense understory (30%) and bamboo (17%) habitats. The group's total home range was 85 ha; on average it used 38.6 ha per month (range 27-55 ha), with an average day range of 1.1 km (range 0.8-1.4 km). Monthly average day ranges increased as frugivory declined, however monthly home range sizes showed no correlation with diet. Encounters with callimicos from other groups occurred on only 2 days. The ranging pattern of *C. goeldii* appears to be influenced primarily by two factors: its seasonal shift in diet requires that it forage in a variety of habitats across the year; and its lack of territorial behavior eliminates the need to patrol boundaries as part of its daily movement. As a result, *C. goeldii* differs from many other callitrichines in its low ratio of day range length to home range size.

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A radiographic study of the impact of race and sex on 1st and 2nd molar development.

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Research aimed at understanding the variation in tooth formation due to race and sex helps to more accurately determine the age at death of remains of subadult individuals. This project examines the impact of race, sex, and time period on first and second molar development. The sample consists of 303 panorex radiographs of individuals from southern Louisiana with known age, sex, and racial affinity (Black or White), ranging in age from 4 years to 14 years. The first and second molars are scored for developmental stage according to the method developed by Demirjian, Goldstein, and Tanner (1973). Statistical analyses explore the effects of each variable on molar development and analyze the variability in this sample.

Variance analyses show large variation within racial and sex groups comparable to variation between groups. Such results challenge notions of definable biological race categories and point to significant individual variation in dental development. Much more variation is seen during enamel formation than during other stages. Although the results of statistical analyses revealed no significant difference ($p < .05$) in timing of dental development between race, sex, or decade groups, mean comparisons did show differences, especially with regard to sex and decade differences. Girls have an earlier average age at each stage of second molar development than boys. An increase in average age at each stage of development from 1980s to the 1990s suggests that at least some secular change has occurred in recent years. These results indicate that variation in dental development warrants further study.

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Hand manipulation skills of gibbons.

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Current neurological research has suggested that hylobatids lack capacities for higher cognitive functions characteristic of the great apes; accordingly little research has been done on the behavioural expressions of cognition in the lesser apes in conjunction with their hand manipulation skills. Previous researchers have suggested that gibbons possess limited ability to grasp objects because of their unique hand shape; however information on the manipulative abilities of their hands is scarce. Object use and hand manipulation skills were monitored in this study, as an attempt to understand the ways in which gibbons use their hands to transport, manipulate and hold objects, which in turn offers insight into the cognitive and functional abilities of the species.

Focal animal studies on two pairs of adult gibbons recorded all manipulation of objects (including introduced items), individual activity patterns, and interaction between group members to discern if gibbons are capable of finding ways to use their hands to manipulate objects as other apes do. Preliminary analysis of data suggests that gibbons are able to manipulate objects in a variety of different manners. Frequency of specific types of hand contact with objects suggest that there are significant differences between the sexes in terms of object manipulation, as well as time spent in contact with various objects. It is apparent that gibbons use their pollex extensively during a variety of activities and they appear to show marked differences in the way they use their hands to manipulate objects that are suspended versus loose (mobile).

Middle Pleistocene auditory ossicles from the Sierra de Atapuerca (Spain).

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The present study describes and compares the large collection (n = 25) of auditory ossicles from the Middle Pleistocene site of the Sima de los Huesos in the Sierra de Atapuerca in Spain with living great apes and humans and selected fossil hominids. Although the Atapuerca mallei tend to fall toward the upper size range of living humans, the manubrium length is nearly identical, and in all of the most diagnostic variables, the Atapuerca specimens are easily differentiated from the great apes and very similar to living humans. The principal dimensions of the incus also show the Atapuerca specimens to differ little from modern humans, and the very straight long process which seems to characterize the Neandertal incus is not present in the Atapuerca hominids. The stapes, however, clearly retains the primitive characteristic of a small footplate seen in the living great apes and *Australopithecus africanus*. The footplate area in the Atapuerca specimens falls toward the lower limit or outside of the modern human range of variation, and is more similar to the gorilla mean value. Morphologically, the Atapuerca specimens show an anterior deflection to the stapedial head, a condition which is also present in the few known Neandertal stapes. The functional significance of this trait is not at present clear, but may indicate a slightly different relative positioning of the stapes head within the tympanic cavity. These anatomical traits in the Atapuerca sample suggest that the auditory ossicles in the genus *Homo* are a source of important phylogenetic information.

The Excess Iron Hypothesis: High levels of iron in infant formula may influence infant health via lactoferrin saturation.

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Since 1979, the American Academy of Pediatrics has recommended that infants receive only iron-fortified formula in an attempt to prevent iron deficiency anemia. This fortification has significantly improved infant health by reducing the proportion of infants with iron deficiency anemia in the United States. However,

iron fortification has also introduced the potential for diseases related to excess iron which may predispose an infant to infection.

This paper proposes a mechanism by which high levels of unbound iron, such as that found in infant formula, may increase illness risk via effects on lactoferrin, an iron transport protein commonly found in mucosal secretions and mammalian milks. Lactoferrin plays a significant role in immune defense as an anti-viral, anti-bacterial, and anti-fungal agent. At birth, infants are unable to produce lactoferrin, and are reliant upon lactoferrin from breast milk for the first several months of life (Goldman et al. 1990).
It has been established that formula fed infants are at a greater risk for infection than breast fed infants (Ball and Wright 1999). Problems with the management of iron resources, through a lactoferrin mechanism, may be one mechanism increasing the risk of illness among formula fed infants.

There are potentially two key mechanisms by which lactoferrin could contribute to these health differences: 1) lactoferrin sequestration of iron in breastfed infants could limit the iron available for bacterial growth, and 2) over-saturation of available lactoferrin with iron in infants fed formula could limit the immunological functions of lactoferrin.

Biological anthropology, evolution, and science: a new perspective on why the theory of evolution is not resonating with the general public.

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In 1991 and again in 2000, the Gallup Organizations asked the American public their opinions about Evolution versus Creationism. This sample of the American public was merged into one large category labeled "Everyone." Broken down, this category consisted of men, women, college graduates, no high school diploma, income over 50,000, income under 20,000, Caucasians, and African Americans. The public responded to three belief systems: Creationism, Theistic evolution, and Naturalistic evolution. Forty-seven percent believed God created man in his own image within the last 10,000 years, 40% believed man had developed over millions of years from less advanced forms of life but God guided this process including man's creation, and a mere 9% believed that man developed over millions of years from less advanced forms of life; God had no part in this process. The 2000 data showed little change.

Human beings in general and the American public in particular have always had problems grasping "deep" time, in which major evolutionary events occur. In contrast, they seem to accept without anxiety changes that occur within 50 or 100 years, i.e., changes in stature in Asian populations from 1900 to 2000, etc., not realizing that this *too* is a form of evolution. This ignorance of science especially when evolution is *supported by the same science* further isolates evolution. In summary, the ignorance of science and evolutionary time coupled with the almost blind acceptance of the recent date for "creation" has worked on the general public to dampen the sound of Evolution.

Morphological study of the upper limb articulations and muscular insertion in humans.

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Many studies have shown that muscular contractions seem to impose important physical forces on the articular surfaces and other tissues, such as the joint capsule, ligament, tendons, and articular cartilage. During growth, continued use of the muscular forces helps regulate the development of the joint and reduces risk of damage to the tissues. Since few studies have been able to demonstrate directly the influence of the muscular contractions on the shape of the joints in humans, this study investigates whether or not size and/or shape of the articulations of the upper limbs change according to the forces that cross them. It is hypothesized that the favored side of the upper body will have larger or differently shaped articular surfaces. Upper limbs are used because they are not involved in locomotion and are often recruited for asymmetrical activities. Size of the muscle insertions for each side of the body is used as a surrogate for the charges incurred by upper limb articulations during life. So far, the results show an asymmetrical tendency of muscle insertions at the individual level, but no significant correlated differences in the joint sizes. Possibility, differences in loads incurred by articulations of the right and left arm may be reflected by shape differences rather than just size differences.

Energetics of chimpanzee locomotion: Force production during bipedal and quadrupedal walking.

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In 1973, Taylor and Rowntree performed the only study to date measuring energy costs of locomotion in chimpanzees and found similar costs regardless of whether they walked quadrupedally or bipedally. Additionally, the cost of locomotion for chimpanzees was 30% higher than those of similarly sized mammals. However, because the Taylor and Rowntree (1973) sample consisted of two young juveniles, researchers have questioned the reliability of these data. Despite the debate over their study, we still do not fully understand the determinants of chimpanzee energetic costs, and therefore cannot easily interpret the results of Taylor and Rowntree (1973) or apply them to the hominid fossil record.

We examined locomotor biomechanics in a sample of five chimpanzees (two juveniles and three adults) within the context of the Force Production model, which suggests that locomotor energy costs are determined by the amount of muscle volume used to generate force to support body weight and the rate of force generation. Chimpanzees use longer contact times during quadrupedalism compared to bipedalism, suggesting they can produce muscle force at slower rates, and therefore should have lower quadrupedal energy costs. Our results show that longer quadrupedal contact times are offset by the use of forelimb muscles that have relatively long muscle fascicles, and therefore activate larger volumes of muscle per step compared to bipedalism. Therefore, the force production model largely explains why chimpanzees do not pay an extra energetic price for walking bipedally. The implications of these results for the evolution of hominid bipedalism will be discussed.

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The significance of derived characters that *Australopithecus afarensis* shares with the robust clade.

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With the recent discovery of a virtually complete *Australopithecus afarensis* mandible, our attention was drawn to the similarity of its ramal outline to that of robust australopiths. Both species display an extremely wide, elevated coronoid process that constitutes a large percentage of the ramal width. The coronoid's superior end is flat and terminates in a posteriorly pointing tip, lending the process a hook-like appearance. As a result, the mandibular notch is narrow and confined. Quantification of the ramal outline confirmed the results of our visual observations. This morphology joins other characters that *A. afarensis* shares with the robust australopiths, including the pattern of blood drainage from the brain, which differs from the common primate pattern; the robustness of the mandibular body; and the proportion of the total facial height occupied by the mandibular body's depth. Although *A. afarensis* still exhibits rather primitive facial and dental morphology, the features that it shares with

the robust australopiths indicate that it is not primitive enough to fulfill the role of common ancestor to both humans and the robust clade.

Variation in the upper-midface of modern 'Hispanic' samples compared to Caucasoid and Amerindian samples.

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The interorbital method can separate Caucasoid from Amerindian crania with considerable accuracy. However forensic anthropologists face a problem when attempting to identify admixed remains with this method. The crania in this study are suspected to possess a genetic contribution from Caucasoid and Amerindian populations. This study tests the hypothesis that admixed individuals will not resemble either the Caucasoid or Amerindian sample. The results are quite variable when attempting to identify admixed remains employing this method's classification scheme. One should take into account the traits that each parent population contributes to the succeeding generations. This study examines the utility of the interorbital method developed by G.W. Gill and colleagues applied to admixed samples. The method gathers data from the interorbital area measuring breadths from paired points and subtenses of the nasals using a simometer. Measurements using the interorbital method are taken on 50 modern admixed human crania from Mexico City (Mestizo), in addition to 15 modern crania from the Maxwell Museum of Anthropology classified as 'Hispanic.' A modified classification scheme finds that 56% of the Mexico City sample is classified as Amerindian with 20% as Caucasoid, or 24% as unclassifiable. 73% of the Maxwell sample is classified as Caucasoid and 27% as Amerindian. This classification shows that forensic anthropologists face an accuracy problem when assessing ancestry from admixed remains. The parental populations of admixed populations should be taken into account when classifying these populations.

Stress among Chinese university women: Preliminary findings among rural and urban populations.

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University life in China provides an urban, modern environment for young Chinese adults. This often means exposure to drastic differences in ideology, culture, and material environments for students coming from rural China. Understanding this transition and adjustment has theoretical as well as applied contributions. Preliminary findings are presented here from a biocultural study of stress among rural and urban female university students. Stress is measured via blood pressure, EBV antibody analysis, and both the researcher's and the individual's assessment. Policy implications and future research goals are discussed.

Women (N=180) were recruited from a southeastern provincial university in the People's Republic of China. Each woman participated in three sitting blood pressure readings, a finger-prick blood draw for EBV antibody analysis, anthropometric measurements, and a questionnaire and semi-structured interview exploring household background, social support, stress, and goals. Rural and urban backgrounds were defined by a self assessment and an index of household background created through the inclusion of several indicators of material style of life, ideologies, goals and exposure to urban environments. This second measure is employed to create a more continuous variable of household background that is more inclusive of moderate or more middle backgrounds. The validity of this measurement of household background is discussed. Upon preliminary analysis, significant differences ($p<0.05$) were observed among self-identified rural and urban women in the following variables: BMI, triceps and scapular skinfolds, arm and calf circumference, and multiple measurements of household backgrounds including family income and a measurement of personal material style of life. There was no significant difference in blood pressure.

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Image-based measure of torsional stiffness of skeletal elements: incorporating tissue inhomogeneity with cross-sectional geometry and its implication for comparative biomechanics.

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Modeling torsional stiffness in the primate skeletal elements is challenging given both variation in cross-sectional geometry and heterogeneity inherent to bone tissue. The computationally simple polar moment of inertia (*J*) is only valid in restricted contexts but is often used out of convenience under the assumption that modest errors ensue. An "exact" solution for torsional stiffness that includes geometrical complexity, loading parameters, boundary conditions, and material variation involves application of structural finite element models whose implementation for comparative purposes is currently impractical.

We have developed a method for approximating the torsional resistance of skeletal elements that incorporates the irregular geometries of and the inhomogeneous bone tissue stiffness distribution within cross sections. Our approximation assumes the corpus to be a prismatic or slightly tapered rod under torsion at each end. We use radiographic grayscale variation to determine an effective shear modulus and thereby arrive at an image-based measure of torsional stiffness.

We apply our method to a sample of great ape mandibular corpus sections. Incorporation of heterogeneity data in addition to geometric information significantly disrupts the rank ordering of individuals within and across samples with regard to relative stiffness. These stiffness values derived under our method are not proportional to corresponding values of *J*; rather, these values are more accurately characterized as being proportional to the reciprocal of *J*. These findings establish that the metrics used to infer torsional stiffness and strength in the literature will, in most cases, fail to predict shear stress and strain values with suitable accuracy.

Joint plasticity, degradation and aging in the masticatory complex.

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Research on the longitudinal effects of altered biomechanical stresses on the anatomy and integrity of joint systems is important for several reasons. First, paleontologists require an understanding of the extent behavioral variation induces morphological variation due to adaptive plasticity. Second, aging is often characterized by degenerative changes in soft- and hard-tissues due directly or indirectly to the cumulative effects of repetitive or excessive loads. Our study presents a multifactorial and temporal analysis of the mandibular symphysis and TMJ in growing rabbits raised on foods of different material properties as well as myostatin deficient mice. Such variation in jaw-adductor muscle activity and forces are known to underlie variation in loading patterns, which in turn are posited to affect macro- and microanatomical varia-

tion in joint tissues. Data are derived from morphometric, microCT, histological and immunohistochemical analyses.

Results indicate that rabbits and mice routinely subjected to joint over-loading exhibit significantly larger masticatory structures, greater biomineralization and more robust jaw joints. Soft-tissue components of the TMJ and symphysis also develop marked anatomical changes linked to postnatal variation in masticatory loading patterns, specifically changes in extracellular matrix elements related to variation in compressive and tensile loads. Interestingly, some of this 'adaptive' plasticity may reflect compensatory changes in one tissue type to offset degradative changes in another component of a joint system. This highlights the great benefit of integrating myriad sources of data so as to provide a comprehensive rendering of the cascade of ontogenetic changes in joint bony and connective tissues vis-à-vis altered mechanical loads.

Patterns of clavicular asymmetry in relation to humeral asymmetry in humans and great apes.

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Previous studies on clavicular and humeral bilateral asymmetry examined them separately. As they are parts of a functional unit, however, examining them together would benefit understanding patterns of asymmetry in the upper limb. This study examines whether patterns in length and average diaphyseal asymmetry significantly differ for clavicles and humeri among humans. These patterns are also compared to those of chimpanzees and gorillas, whose lateralized behavior and upper limb mechanics differ considerably from humans.

400 Native American and Egyptian skeletal remains were measured, as were 10 great apes. Clavicular and humeral maximum lengths and average 50% humeral and clavicular diaphyseal diameters were measured. Percentage directional asymmetries (%DA) and percentage absolute asymmetries (%AA) were calculated to allow for direct comparison of asymmetries in dimensions of different size. Nonparametric tests were used in analyses due to limitations inherent in analyzing proportional data.

As demonstrated previously (Auerbach and Ruff, in press), human humeri are significantly right biased in length and diaphyseal breadth %DAs and %AAs. Males have greater diaphyseal asymmetry and females have greater length asymmetry ($p<0.05$). %DA and %AA are greater in clavicular than humeral dimensions, and are not sexually dimorphic. Clavicular length is significantly left biased, though diaphyseal breadth is significantly right biased. Individuals exhibit crossed symmetry in humeral and clavicular length asymmetries. As expected, there are no systematic humeral or clavicular asymmetries in chimpanzees and gorillas. These results suggest humans have a unique pattern of upper limb asymmetry, and further indicate some independence in length and diaphyseal asymmetries in human limbs.

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A reassessment of the "gracile" vs "robust" dichotomy in the Pleistocene of Australia.

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Pleistocene human crania from Australia have been assigned to "gracile" and "robust" categories as descriptors of their size and morphology. These categories have likewise been cited as evidence for the existence of multiple founding populations for the continent. Individuals from the Willandra Lakes region are commonly used to support these hypotheses as they appear to exhibit great variation in cranial robusticity. Contributions to this discussion have so far neglected the relatively large post-cranial sample available from the region. This paper will assess the validity of claims for multiple populations being represented in the post-crania from the Willandra Lakes.

Our team collected an exhaustive battery of postcranial measurements from the available Willandra Lakes skeletal sample, including both the specimens published by Webb (1989) as well as a number of undescribed individuals discovered more recently. These measurements will be compared to a number of Australian samples both from the Pleistocene as well as the Holocene, in an effort to examine whether Willandra Lakes post-cranial material falls within the range of variation for other, modern and ancient, Australian populations.

Our results suggest that that the terms "robust" and "gracile" may only be useful for the discussion of Australian crania and not appropriate in the description of post-cranial samples. For example, the Lake Mungo 3 individual is commonly considered to be "gracile" and yet exhibits large and relatively "robust" post-cranial skeleton. Further, our findings cast doubt on the presence of two separate populations being represented in the postcranial sample from the Willandra Lakes.

Genetic structure and admixture among U.S. ethnic groups based on Y-chromosome SNPs.

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We typed a set of 61 Y chromosome single-nucleotide-polymorphisms (Y-SNPs) in a sample of 2,517 individuals from 38 populations to quantify population structure and admixture among African-American, European-American, Hispanic-American, Asian-American, and Native-American ethnic groups. An analysis of molecular variance indicates that most of the genetic variance (64.7%) is found within populations; a notable amount (33.3%) is found between ethnic groups while only 1.9% is found within each ethnic group. Only the Native-American populations contain significant among population variation. Admixture estimates vary greatly among populations and ethnic groups. The frequencies of non-European (3.4%) and non-Asian (4.5%) Y chromosomes are generally low in European-American and Asian-American populations, respectively. The frequencies of European Y chromosomes in Native-American populations range widely (i.e., 7-89%) and follow an East to West gradient, whereas the frequencies of European Y chromosomes in African-American populations is relatively consistent (26.4% ± 8.9%) across different locations. The European (77.8% ±9.3%) and Native-American (13.7% ±7.4%) components of the Hispanic paternal gene pool are also relatively consistent among geographic regions; however, the African contribution is higher in the Northeast (10.5% ± 6.4%) than in the Southwest (1.5% ± 0.9%) or Midwest (0%). The history of paternal admixture in the U.S. has been neither symmetric nor geographically uniform.

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Studies of genetic variation and their relevance to questions of the origin and evolution of human species.

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It has become increasingly common to consider the past two million years of human evolution in terms of several taxa, including *Homo erectus*, *Homo heidelber-*

gensis, *Homo neanderthalensis*, and *Homo sapiens*, although considerable debate remains over whether these labels best represent reproductively distinct species, semi-species, or sub-species, and the extent to which their relationship over time can best be described by anagenesis or cladogenesis. Genetic data have often been used to support a model of modern human origins in Africa followed by an expansion with replacement outside of Africa. This conclusion, based in large part on evidence from mitochondrial and Y-chromosome DNA, has been called into question by several new lines of evidence, including: 1. lack of a consistent signature of population expansion in nuclear DNA, 2. Templeton's multilocus analysis demonstrating several expansions out of Africa combined with admixture with populations outside of Africa, and 3. Eswaran's demonstration of how a diffusion wave process could have incorporated archaic human genes during the transition to, and subsequent expansion of, modern humans in Africa. These findings are reviewed and considered in terms of possible evolutionary relationships between three morphospecies: *H. erectus*, *H. heidelbergensis*, and *H. sapiens*. It is suggested that each of these "stages" in human evolution was accompanied by a dispersion out of Africa combined with gene flow, resulting in primarily (though not necessarily exclusively) anagenetic transitions in Pleistocene human evolution. However, the exact role of Neandertals in this process is still not clear.

Impacts of human activity on apes and other mammals at the Dzanga-Sangha Reserve, Central African Republic

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Collaborative biological and cultural anthropological research examines the impacts of humans on apes, monkeys, and other mammals in the Dzanga-Sangha Reserve (RDS), Central African Republic, an integrated conservation development project (ICDP), since the late 1980s. The local human population at RDS has expanded five fold in recent years with increases in hunting, logging and diamond extraction. Duikers and primates are principal protein sources; increasing numbers of apes and elephants are now sold as bushmeat. Preliminary research has suggested local declines in these species. Analysis of repeated transects in different sectors of RDS at intervals over a 20 year period permit assessment of changes in the relative frequency of mammal abundance with respect to distance from villages, hunting intensity and logging activity. Historical records and ethnographic interviews allow us to address the relative impact of logging and conservation activities on resource use and mammals in the protected area since its inception. This study indicates great declines in mammal abundance in community hunting and logging sectors; with humans no longer restricting their activities close to the villages. Many Park sectors also show increasing human impacts and declines of wildlife. Local residents have responded to booms and busts in the local logging industry by increasing commercial hunting and diamond extraction, escalating declines in wildlife. This study helps us to evaluate the relative successes and challenges of the ICDP model of conservation and argues for both increased community participation and law enforcement as ways to improve conservation outcomes in Congo Basin forests.

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Evaluation of estimated dental age versus real age of "unknown" bodies - a 20-year survey.

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The aim of the study was to evaluate the reliability of methods used for forensic dental age estimation. We found all cases over the last 20 years (1984 – 2004) where unidentified bodies were examined for identification purposes (including age assessment), and where secure identification was subsequently achieved. In all, the study included 51 cases and 11 different methods had been used for estimation, with the Bang/Ramm and the Gustafson/Johanson methods being the most frequent. The age estimates had usually been recorded as 10-year intervals. Real ages were in the range of 6 – 76 years, the largest concentration of cases being in the age interval of 25 – 55 years (34 cases). There was good agreement between estimated age interval and real age in 37/51 = 72% of the cases. In 8 cases the real age deviated up to +/- 5 years from the estimated age, and in 6 cases more than 6 years. Overall, the average difference between real age and estimated age was 4,5 years.

Our study showed that forensic, odontological age estimates are reliable. Future considerations for age estimation could be a computer based visualisation/evaluation of selected age estimation methods, focusing on morphometrical analyses. Such a study will be done in the near future at the Institute of Forensic Medicine, University of Copenhagen.

Comparative morphology and allometry of the *Orrorin tugenensis* femora.

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Analyses of the femora attributed to *Orrorin tugenensis* suggest that they provide among the earliest evidence of hominin bipedalism, and characterize them as being morphologically more similar to those of humans than to those of *Australopithecus afarensis*, especially AL 288-1. This study examines the *Orrorin* femora (BAR 1002'00, 1003'00, 1215'00) in a comparative and allometric context in order to test hypotheses about their morphological affinities and functional morphology.

Measurements were collected on proximal femora of a large sample of adult humans (n=132), chimpanzees (n=49), bonobos (n=14), gorillas (n=59), orangutans (n=32), and most available early hominin taxa. The human sample includes individuals from large- and small-bodied (African Pygmy, Andaman Island) populations. Scaling was examined by comparing individual measurements to proximal femur size, defined as the geometric mean of all femoral measurements.

Results show that, at their relatively small size, the *Orrorin* femora are characterized by unusually long and anteroposteriorly narrow necks, like those of *A. afarensis* (AL 288-1, AL333-3), *Paranthropus robustus* (SK82, SK97), and KNM-ER1503 (*P. boisei* ?), but unlike those of extant great apes and fossil and modern *Homo* (KNM-ER1481, KNM-ER1472, Berg Aukus). The femoral head is relatively large compared to *Australopithecus*, *Paranthropus*, and African ape femora, but smaller than those of extant orangutans and humans. Overall, the *Orrorin* femora are most comparable to early hominin femora, weakening support for scenarios in which *Orrorin* is ancestral to *Homo* to the exclusion of *A. afarensis*, but supporting arguments that *Orrorin* is a hominin and adapted to bipedalism.

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Sentry male behavior of the Mesoamerican black howler monkey (*Alouatta pigra*) at the Calakmul Biosphere Reserve, Mexico.

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The vast majority of studies of the Mesoamerican black howler monkey (*Alouatta pigra*) have focused on populations within rapidly disappearing fragmented forests to further characterize the genus. Only recently have studies of *A. pigra* within undisturbed forests been conducted. To date, demographic data

from undisturbed habitats have derived primarily from brief population surveys of this species.

In contrast this presentation introduces new behavioral data as an important variable to explanations of howler group dynamics. In this study, demographic and behavioral data was collected from three social groups of *A. pigra* within the Calakmul Biosphere Reserve in the southeastern portion of the Yucatan peninsula, Mexico. A series of intensive non-invasive observations was performed during June and July 2001 and January and February 2002 representing natural wet and dry seasons, respectively. Data was collected on social organization, group composition, diet and activity patterns for each social group.

By far the most significant contribution of this study is the documentation of sentry male behavior. This proximal spacing of adult males relative to the rest of their group appears to be a ubiquitous feature to this population. Indeed, there may be a correlation between sentry behavior and the observed lack of dawn and dusk vocalizations. As previous studies of *A. pigra* group dynamics have suggested inter- and intra-group differences based on habitat, documentation of behavioral anomalies such as that observed in this study, and particularly that of sentry male behavior, now argues for a more complex explanation for *A. pigra* social structure and adaptation.

Adaptive diversity, growth, and development in Chalcolithic India.

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The development of sedentary agriculture is often associated with growth suppression and an increase in stress markers in human populations (Cohen and Armelegos 1982; Steckel and Rose 2002). Archaeologists have proposed a transition from settled agriculture to semi-nomadic pastoralism at the beginning of the Late Jorwe (3100-2700 BP) period at Chalcolithic Inamgaon, India (Dhavalikar 1988). Data on decreasing LHPC frequency in the Late Jorwe at Inamgaon supports this hypothesis (Lukacs and Walimbe 1997). However, recent reevaluation of the archaeological record (Panja 1995, 1999) and LEH frequencies (Lukacs 1992) indicate that perhaps there was a more subtle shift in species preference in an economy that was diverse throughout the sequence. This study examines growth in long bone length, cortical bone maintenance, and bone histology for 79 sub-adults (0-5 years) from Early and Late Jorwe Inamgaon. Long bone growth and cortical area are particularly strong indicators of nutritional status for infants and children (Larsen 1995; Cameron 1998; Steckel et al. 2002) and a dramatic shift in subsistence and mobility should result in differences in growth and development. Both periods demonstrate growth suppression in late infancy and a decline in the quantity and quality of cortical bone after 6 months of age. However, the lack of significant differences between the Early and Late Jorwe in length of the humerus ($p = 0.6000$) and the femur ($p = 0.792$) and in % cortical area ($p = 0.454$) supports the hypothesis that more subtle shifts in subsistence occurred in the Late Jorwe.

Out of Africa with admixture.

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Human genetic loci seem to tell differing stories about the origin of modern humans. Some support a recent African origin, others a long history of subdivision. The "diffusion wave hypothesis" of Eswaran and others makes sense of this. It has recently received additional support from loci suggesting admixture between archaics and moderns. This presentation will argue that these data cannot be explained by balancing selection or by a long history of less than complete geographic subdivision.

The data imply that the modern population includes alleles derived from populations that were separated from most of the Pleistocene. The rate of gene flow between these populations was probably no greater than 10^{-6} per year.

Comparative growth plate kinetics in rodents: insights into the evolution and development of limb length allometry.

C. Rolian. Department of Anthropology, Harvard University.

The primate appendicular skeleton shows significant diversity in the proportions of fore- and hindlimbs. Humans have proportionately longer hindlimbs (intermembral index = 0.70), quadrupeds have limbs approximately equal in length (IMI=0.95), and brachiating apes have the longest relative forelimb length (IMI >1.20). These differences are thought to have evolved in response to selective pressures relating to the energetics and biomechanics of locomotion. However, the developmental mechanisms that selection acts upon to generate these interspecific differences have been poorly studied. For example, differences may be due to changes in rates affecting endochondral bone growth, or they may result from variation in the cellular properties of physeal growth plates, such as the size and number of proliferative and hypertrophic chondrocytes. Here I present a rodent model to address these hypotheses, using cross-sectional ontogenetic series of two species, the house mouse (*Mus musculus*, n=14, IMI=0.73) and Mongolian gerbil (*Meriones unguiculatus*, n=16, IMI=0.63). In each individual, left limbs were used to determine bone growth rates; and right limbs were thin-sectioned for analysis of cellular properties in the growth plates of the proximal humerus, distal radius, distal femur, and tibia. Results indicate that differences in rates of chondrocyte proliferation are significantly correlated with interspecific differences in bone growth rates and interlimb proportions. Cellular properties of the growth plates do not contribute significantly to differences in growth or limb proportions between species or ontogenetic stages. These findings are discussed in the context of the developmental genetics and evolution of primate limb proportions.

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Preservation of the La Jolla skeletal population's cranial morphology.

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The San Diego Museum of Man's La Jolla skeletal population is comprised of 82 individuals who mainly occupied the coastal region of San Diego County approximately 9000 to 3000 BP. Of these 82 individuals, at least 32 have crania that may be of interest for future research. In an attempt to preserve as much information on the cranial morphology of the La Jolla skeletal population as possible, we have taken digital photographs of all aspects of these crania (anterior, lateral, posterior, superior, and inferior views). In addition, we have electronically recorded Cartesian coordinates (x, y, z) of various cranial landmarks using a digitizer. The benefit of collecting three-dimensional coordinate data is that the spatial arrangement of the landmarks is retained. Relative to traditional one-dimensional (linear) measurements, such as cranial length and breadth, Cartesian coordinate data allows for a much more accurate reconstruction of the cranial morphology. This project is especially timely due to the fact that there is an imminent possibility that this collection will be repatriated. Therefore, we are trying to preserve as much data as possible while the skeletal remains are still available. A potential future direction of this project is the coupling of the image files with the coordinate data. Ideally, it would be possible to merge these two data sets to get a final three-dimensional computerized representation of the La Jollan's cranial morphology; i.e., images that can be rotated on an axis.

***HLA-DQB1* allele diversity, reproduction and health in consanguineous and non-consanguineous families in Bangladesh**.

S. Roy Choudhury, L.A. Knapp. Department of Biological Anthropology, University of Cambridge.

Human leukocyte antigens (HLA) play important roles in human health and reproduction. HLA genes encode proteins which control cell-cell interactions and peptides capable of T-cell stimulation. It has been argued that HLA heterozygous individuals will have advantages for disease resistance due to their diversity of peptide binding molecules. Contrastingly, HLA homozygotes may suffer deleterious health consequences if they cannot respond to a range of immunological challenges. In populations where consanguineous matings occur, HLA homozygosity may be high since consanguineous relatives are more likely to share HLA alleles identical by descent. While it is possible that offspring from close-kin matings may have health disadvantages, the impact of these matings on human fitness remains contentious. This study assessed HLA-DQB1 homozygosity and health status in non-consanguineous and consanguineous couples in Bangladesh. DNA was obtained from hair and buccal cell samples collected from 44 non-consanguineous and 36 consanguineous families living in Dhaka, the capital of Bangladesh. HLA-DQB1 typing of 308 individuals was conducted by reference strand conformation analysis (RSCA) and reproductive and health data was collected from mothers using questionnaires. Overall, there were differences in the number of alleles in consanguineous and non-consanguineous groups, but no significant differences in frequencies of alleles or genotypes shared by both groups. Additionally, an excess of homozygous offspring was observed in non-consanguineous couples ($p= 0.06$), consanguineous couples ($p= 0.009$) and all couples together ($p= 0.0015$). These results will be discussed in the context of health and reproductive data from the study population and general anthropological issues.

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Ethical implications of ancestry testing and genetic identity.

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Advances in human genetics and the understanding of human genetic variation have revolutionized not only biomedicine but also the inquiry into personal genealogical histories and ancestral origins. The rapid growth in the number of companies offering ancestry testing through DNA analysis has fueled and has been fueled by the interests of various individuals and groups seeking additional insight into their genetic and social identities.

However, this new wave of genealogical services raises a number of unique as well as familiar ethical and psychosocial issues. This presentation highlights some of the most prominent of these issues including: database access and security; privacy and confidentiality of information; misuse and/or misapplication of test results; the informed consent process; and the psychological impact of the test results. Implications for scientists leading these efforts are also discussed.

Mandibular size dimorphism in Middle and Late Pleistocene archaic human populations.

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While studies of archaic human postcrania have revealed modern human-like levels of size variation, several workers have opined that the mandibles exhibit greater dimorphism than modern humans, although this has not been quantified. This study investigates size variation and, by inference, sexual dimorphism in the mandibles (corpus height) and teeth (buccolingual crown diameters of M_1 and M_2) of Middle to Late Pleistocene archaic human populations. Seven fossil samples representing three species were analyzed: *Homo sapiens* (Klasies River and Skhul), *H. heidelbergensis* (Arago and Sima de los Huesos), and *H. neanderthalensis* (Krapina, Shanidar and Vindija). Three geographically diverse recent human samples (Inuit, Nubian and Zulu) of mixed sex were employed as reference samples. For each comparison, 10,000 randomized samples allowing replacement were generated in order to test the null hypothesis that the variation in each fossil sample did not exceed the level found in the reference sample.

The results of this study demonstrate a variable and heterogeneous pattern of size variation in archaic humans. For example, the early *H. sapiens* (Klasies, Skhul) and *H. heidelbergensis* (Arago, Sima) samples were each significantly more variable in mandibular corpus height compared to most reference samples. The Klasies sample also showed statistically significant variation in molar buccolingual crown diameters. On the contrary, while the Neandertal samples were generally variable, they were not significantly more dimorphic than recent humans. These mixed results probably indicate variability in the degree of dimorphism among archaic human populations, and that the mandible is more dimorphic in some archaic populations than in recent humans.

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Mitochondrial DNA variation in Old Believer and ethnic Russian populations of northern Siberia.

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We surveyed 201 unrelated Old Believers for mtDNA variation from Burnyi in the Baikitsk Raion of the Krasnoyarsk Krai, and Isetsk and Kirsanovo in the Tyumen Oblast. We also analyzed mtDNA variation in 169 unrelated ethnic Russians from three villages across Siberia. Results from SNP analysis and control region sequencing indicate that West Eurasian haplogroups are the predominant mtDNA lineages present in Old Believers, with haplogroup U comprising 30%, haplogroup H 28%, T 12%, K 5%, and J 4.5%. Other West Eurasian lineages found in them include haplogroups I (3%), W (1%), and X (1%). There was also considerable mtDNA variability between villages, with haplogroups T, J, W, and X found at highest frequencies in the Burnyi village in the Baikitsk Raion of the Krasnoyarsk Krai, and haplogroups H, U, K, and I found at highest frequencies in the Kirsanovo village. Although many haplogroups are shared between Old Believers and ethnic Russians, they vary in frequency. Ethnic Russians contain higher frequencies of haplogroups H (44%), J (6%), and W (5%), and lower frequencies of haplogroups U (16.6%), T (11%), and K (4%). Somewhat surprisingly, haplogroup C mtDNAs were also detected in Old Believers at a frequency of 2.5%, suggesting that they had admixed with local indigenous groups, since haplogroup C mtDNAs are not usually found in ethnic Russians, and comprise a mere .6% of those sampled. Genetic diversity within Old Believers, the biological consequences of their isolation, and their genetic relationships with other Slavic groups will be discussed.

Life in a Neolithic community: body size and activity levels at Çatalhöyük, Turkey.

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Çatalhöyük is one of the earliest known large agglomerated settlements in the world. Located in central Anatolia (Turkey), the site was occupied between 9400 and 8000 yrs BP. We report here on 24 of the best preserved, recently discovered adult skeletons from the middle-upper levels. While the sample analyzed to date is relatively small, it provides some important insights into the effects of urbanization in this early Neolithic community.

Body mass was assessed from regression equations based on femoral head size, and stature from a Euroamerican formula based on femoral length (crural indices indicate modern European limb length proportions). Cross-sectional geometric properties of the femoral midshaft were determined from biplanar radiographs combined with molding of external contours. The polar section modulus, standardized over the product of body mass and femoral length, was used as a measure of overall relative femoral strength. Comparisons were carried out with a large (n = 228) sample of Upper Paleolithic through Bronze Age Europeans.

The inhabitants of Çatalhöyük were relatively small, with average estimated body masses of 59.6 kg (males) and 54.9 kg (females), and statures of 162 cm (males) and 156 cm (females). However, relative femoral strength was high compared to our European Neolithics, and more similar to our European Mesolithics. The combined results indicate a population that was not particularly well nourished and that engaged in hard physical labor. Results are consistent with a scenario in which the later inhabitants of Çatalhöyük had to work increasingly harder to obtain scarcer resources.

First ever multislice-CT and magnetic resonance imaging of the Iceman, ca. 3300 BC.

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The Iceman - so-called "Oetzi" - a natural human glacier mummy from the Tyrolean Alps dating to ca. 3300 BC, has been investigated scientifically in depth since its discovery in 1991. Non-invasive imaging has been performed on multiple occasions by using conventional / digital radiography, single and spiral computed tomography (CT). Consequently, these investigations revealed e.g. an arrow head still in situ in the thoracic cavity of the mummy (Gostner and Egarter-Vigl 2002). Murphy et al. (2003) summarized the hitherto radiologically detected anatomico-pathological findings as well as the - by CT only - visible ongoing post mortem alterations of the mummy.

We present new imaging data of the Iceman as obtained by the first ever multislice CT (MSCT; Siemens Somatom Sensation 16) and magnetic resonance imaging (MRI; Siemens, Magnetom Harmony) performed on this cadaver (Department of Radiology, General Hospital Bolzano).

The MSCT data allow not only to further trace the ongoing post mortem alterations - such as e.g. marrow air distribution changes - but also help to better visualize the suggested hematoma to be found next to the possibly deadly arrow head. Surprisingly, we were able to achieve high-quality MRI images from the currently still frozen body too, thus enhancing the possible methodical spectrum for analyzing this unique corpse in future studies.

Intrauterine parent-offspring conflict: lessons from the marmoset placenta

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Coall and Chisholm (2003) suggest that differences in the fetal/placental weight (F/P) ratio may reflect variation in intrauterine parent-offspring conflict. Haig (1993) has hypothesized that faced with intrauterine resource restriction, which is likely to happen with an increase in litter size, fetuses may solicit placental overgrowth to meet their demands. The common marmoset (*Callithrix jacchus*) regularly gives birth to twins, and triplet litters are common in captivity. Litter size variation along with maternal condition (age, prepregnant weight, and pregnant weight gain) is explored in relation to placental and fetal weights to answer the following questions: 1) Do twins and triplets differ in their access to the placenta? 2) Do differences in maternal age and weight reflect differences in access individual fetuses have to the placenta? 3) Do differences in F/P ratios reflect differences in intrauterine "strategies"?

Triplets have lower individual birthweights than do twins, but are associated with a relatively greater share of placental tissue (and thus a lower F/P weight ratio), consistent with solicitation of placental overgrowth. Mothers who gain more weight during gestation tend to give birth to offspring with a more limited share of the placenta per fetus, indicating that an elevated maternal nutritional plane during gestation may be reflected by increased placental efficiency and decreased parent-offspring conflict. Twin and triplet fetuses may pursue different intrauterine strategies for maximizing allocation of the placenta. Since complete triplet litters are almost never successfully reared to weaning, the triplet intrauterine strategy represents conflict with maternal interest in long-term reproductive success.

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Influence of workplace programs on initiation and duration of breastfeeding in the United States: a national study, 2005.

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In the United States, more mothers are part of the workforce than ever before. Based on a national survey of infant feeding practices, this study considered the influence that different workplace policies/programs had on the intention to breastfeed. Mothers (n=1,113) with infants (birth to 12 months of age) were contacted by telephone. Nearly all (85%) viewed breast-feeding as healthier for their baby. Seventy-two percent of mothers reported that they breastfed their infant for some period of time during the first year. Of those who were working full-time or part-time at the time of the survey (n=546), 72% indicated that the need to return to work had a big/some impact on the length of time they breastfed; 28% returned to work within 6 weeks after giving birth and an additional 49% of mothers returned to work between 7-12 weeks after giving birth. Only 29% of mothers who worked (prenatally and/or postnatally)(n=874) indicated that their employer provided a workplace policy/program to support breastfeeding or expression of milk. A majority of these mothers (70%) indicated that a dedicated/secured room and flexible break times/work hours for breastfeeding or expressing milk were very important features for an employer to offer. Attitudes concerning workplace policies/programs were evaluated across demographic characteristics including maternal age, education, region of residence, total family income, and ethnic origin. Results indicated that employer programs supporting working mothers who breastfeed are critical for the nation to reach the Healthy People 2010 goals for breastfeeding.

Patterns of morphological homoplasy in extant and extinct Malagasy strepsirrhines.

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omy, New York College of Osteopathic Medicine.

There are conflicting phylogenetic signals between morphological and molecular datasets used to investigate the relationships among and between Lemuriformes and Lorisiformes. For example, molecular data have demonstrated the monophyly and single biogeographic origin of Malagasy strepsirrhines, implying that morphological traits once thought to unite cheirogaleids with Lorisiformes must have evolved convergently. However, the homoplasious characters that have evolved in strepsirrhines have yet to be examined for underlying patterns of convergent evolution. In addition, it has not yet been demonstrated that different data partitions, such as the skull and postcranium, display biases in the number and pattern of convergent character evolution.

This study combines multiple datasets of phenotypic characters in order to characterize and evaluate patterns of correlated homoplasious character evolution in extant and subfossil Malagasy strepsirrhines. Data were analyzed by mapping character distributions onto a molecular tree that includes ancient DNA from several subfossil taxa (Karanth et al. 2005, PNAS). The proportion of characters that evolved convergently either within lemuriformes or between lemuriformes and lorisiformes ranged from 30-40%. The number of characters that evolved convergently within lemuriformes was not considerably different from the number that evolved between the two clades. Results also do not demonstrate a significant bias in convergent characters between cranial and postcranial partitions.

Isotopic evidence for variation in diet and health in the Kulubnarti Christian period of Sudanese Nubia.

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Stable isotope analysis was used to reconstruct the dietary patterns of the Christian period Sudanese Nubian site of Kulubnarti in light of established patterns of health. Extensive paleopathological research has documented higher childhood mortality for the early Christian group (550AD-750AD) than the late Christian group (750AD-1450AD). A demonstrated correlation between childhood mortality and skeletal growth defects associated with nutritional stress at Kulubnarti suggests a difference in diet between the two groups. Archaeological and biological evidence indicates that C3 and C4 cereals were cultivated and consumed throughout the Christian period. Although a shift in diet is a reasonable explanation for the difference in nutritional stress experienced by the two groups, this hypothesis has not been tested. In this study, stable isotope analysis was used to gather empirical information about the diets of Kulubnarti juveniles, adult females, and adult males from both groups. Carbon and nitrogen isotope ratios ($\delta^{13}C$ and $\delta^{15}N$) were analyzed in collagen isolated from ribs. The $\delta^{13}C$ of the late Christian sample (-17.6‰) is subtly, yet significantly different from the early Christian sample (-18.2‰), while the $\delta^{15}N$ of the late Christian sample (9.7‰) is not different from the early Christian sample (9.9‰). However, when the groups are pooled, the Kulubnarti juvenile $\delta^{15}N$ (9.2‰) differs significantly from that of adult females (10.0‰) and adult males (10.4‰). These data suggest significant age and sex related dietary differences during the Kulubnarti Christian period.

Craniofacial growth trajectories and dental development in humans.

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Previous ontogenetic studies suggested that main craniofacial differentiation among primates arises before the M1 emergence, humans developing a large brain and a retracted face by semi-independent growth patterns. This study assesses age-related changes in human craniofacial modules and its associations with dental development. The understanding of associations between different developmental systems at the individual level can give insight on the underlying causes of differentiation and of associations at the evolutionary level.

The skull was decomposed into 8 modules (anteroneural, midneural, posteroneural, otic, optic, respiratory, masticatory and alveolar). Growth trajectories for modules were obtained by the analysis of 226 human skulls of known age at death (0-20) using the non-parametric smoothing spline. All modules grow at high rates up to 3-5 years and at lower rates later. Midneural and posteroneural modules present the highest rates after birth whereas the alveolar one shows the most different trajectory. Changes in growth rates occur just before the emergence of the first permanent tooth, M1. Hierarchical clusters revealed that ontogenetic integration among modules is different before and after the M1 emergence, being the alveolar one the least integrated. Focusing on individuals with full deciduous dentition and those with the full emergence of M1 (with no other cheek-tooth at the occlusal plane) and standardizing by age, growth trajectories were not decoupled. Results would suggest that cranial modules and dentition are connected in some degree. However, the differences in growth trajectories would indicate that modules and as well as dentition are influenced by different underlying developmental factors.

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Somatic Variation in a Wild Population of Ring-tailed Lemurs.

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Understanding somatic variability among wild primates can provide insight into natural patterns of developmental plasticity, but published data are rare. Here we provide such information for a wild population of ring-tailed lemurs. From 2003-05 morphometic and dental data were collected on 141 individuals as part of a long-term study of lemur health and nutrition. A number of variants have been observed. One individual has microtia, in which one ear is normal but the other exhibits an absence of the majority of the pinna. Two individuals are intersex. Both individuals appear to be females with male secondary sexual traits that include masculinized genitalia. The dental variants observed include a supernumerary maxillary premolar, a maxillary premolar that has erupted horizontally, and one individual with a severe case of malocclusion, in which the toothcomb occludes only with the left anterior maxillary teeth. The frequency of non-dental variants is relatively high. Among humans, the frequency of microtia is .02% while among the lemurs it is .71%. The frequency of female pseudohermaphroditism among humans is .008%, while for this population of ring-tailed lemurs it is 1.41%. The frequency of dental variants in our sample is comparable to other lemuriformes, but is far less than that seen in extant hominoids, which, for example, exhibit supernumerary teeth frequencies of up to 8% in some samples. The lower frequencies of dental variants in lemurs may be a product of their relatively fast dental development, when compared to large-bodied anthropoids.

An assessment of the taxonomic validity of *Homo ergaster*.

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The African hypodigm of *Homo erectus sensu lato* is currently a matter of debate. In particular, cranial differences have been used to argue that the earlier African specimens represent a separate species, *Homo ergaster*.

This study utilized geometric morphometric techniques to assess the degree of variation between Asian *Homo erectus* and the proposed representatives of *Homo ergaster*. Casts of African and Asian fossil crania were measured, and the variation in the fossil sample was compared to the variation among 18 presumed male modern human crania representing several geographically distinct populations and 18 chimpanzee crania representing both sexes. A MicroScribe 3DX three-dimensional digitizer was used to collect measurements of 11 cranial landmarks from the extant and fossil specimens. The Morphologika software package was used to perform a generalized Procrustes analysis and the translated data were analyzed using principal components analysis. The average taxonomic distance (ATD) between specimens was calculated for each taxonomic group. The ATDs between individual fossil African and Asian specimens were compared to the total distribution of pairwise comparisons in modern humans and chimpanzees. The ATD between Asian and African specimens falls within the bounds of the observed variation in modern humans and chimpanzees. The results of this study suggest that the level of morphometric differences among Asian and African fossil crania do not warrant the division of this assemblage into *Homo erectus* and *Homo ergaster*.

Can *Khoi San* cranial morphology be explained by paedomorphism?

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Many classic examples of heterochrony do not survive the transition from univariate to multivariate analysis. Among them might be the phenomenon of paedomorphism in humans. We study this possibility using data about craniofacial ontogeny from the *Khoi San* of the Kalahari Desert, a group typically small in stature whose cranial morphology has previously been claimed paedomorphic. In the multivariate context, the classic language of paedomorphy translates into a claim of overlapping growth trajectories that differ only in extension.

47 traditional three-dimensional landmarks and 300 semilandmarks were collected on 116 crania (92 adult, 24 subadult, in a mixed sample of *Khoi San* and Caucasians). Both samples range in age from infancy through adulthood; the samples were group-matched by dental stage. Procrustes shape coordinates were analyzed with principal components analysis in shape space and in size-shape space, and the corresponding ontogenetic trajectories compared (multivariate regressions of shape on log Centroid size).

We find that (1) neurocranial and facial ontogenetic trajectories differ within groups, and (2) both differ as well between the groups. As the trajectories are neither overlapping nor parallel, the differences of ontogenetic trajectory between these two groups cannot, or should not, be explained as heterochrony. This is true both regarding overall cranial morphology and for analysis of facial and neurocranial form separately.

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GM and KM phenotypes and haplotypes in Southwest Asia: Populations at the crossroads.

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SW Asia has a long history of gene flow from Central Asia and contact with Sub-Saharan Africa. Populations here should be admixed consistent with historical and prehistoric population movements. We present GM and KM data from Abkhazians (n=97), Afghanis (n=58), Arab samples from Israel (n=330), Iraq (n=242), and Saudi Arabia (n=88), Israeli Beduins (n=38), and Turks (n=123), and examine the population structure with reference to SE European, African and Asian population samples. GM haplotypes are largely continent specific for East Asia, Sub-Saharan Africa and Indo-Europeans making it an excellent tool for the detection of gene flow. Only two of nine haplotypes detected have ambiguous distributions; all other haplotypes detected are either found in all non-Sub Saharan African populations, African specific, Asian specific or Indo-European specific. The results indicate variable but significant Sub-Saharan African components in Arab and Beduin populations, but not Abkhazi or Afghanis, but significant Asian gene flow in the Afghanis, and varying amounts of Asian gene flow in the other SW Asian populations. Using principal components analysis SW Asians cluster with other Indo-Europeans and reflect the degree of African and Asian gene flow. The overall results support the historical contacts of the populations of SW Asia and reflect the power of the GM haplotypes in dissecting population relationships. *KM*1* frequencies; which only shows variation among populations, with lower frequencies in Indo-Europeans and higher frequencies in Sub-Saharan Africans; correlated with the degree of African admixture (Pearson r = 0.66, p=0.037, Spearman r=0.67, p=0.033) and not Asian admixture.

What does growth mean? Biomedical and adaptationist interpretations.

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Interpretations of growth trajectories fall into two general frameworks. An adaptationist view interprets growth as a means of adaptation while a biomedical view interprets a growth trajectory as a measure of child health, and by extension of community health. In the former, slow growth, departures from norms, etc. can be adaptive while in the latter view, it indicates poor health. Some attempts to resolve the apparent opposition in interpretative frameworks have focused on the problem of operational levels (population vs. individual benefit), and though making an important distinction, has not forged a resolution. One resolution strategy is a program of empirical tests of relationships between environmental stressors, growth and adaptation in terms of some measure of benefit other than growth such as fitness or more commonly, function. This would be a program of "regular science" in Kuhnian terms. Some research using this approach has been conducted. However, testing these relationships is complicated by the lack of agreement as to what constitutes a proof of adaptation. Another approach is the formation of a decision rule regarding the application of different interpretative frameworks. Indeed, some regularities already exist in the application of interpretive frameworks. This paper describes the problem, and seeks a resolution in terms of a decision rule for the application of interpretative frameworks, using data from current research on toxicants and growth, as well as empirical tests of growth - function relationships by others.

Minicolumns in Broca's area in apes and humans

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We analyzed minicolumns in Brodmann's areas 44 and 45 in both hemispheres of the ventrolateral frontal cortex of human, chimpanzee, bonobo, gorilla, and orangutan brains using a quantitative approach. A semi-automated method

based on ImageJ software was used to digitize images of Nissl-stained material. Minicolumns were compared for spacing distance, neuropil space, and gray level index (GLI) across species.

We found that minicolumns in BA44 and BA45 in apes were generally as large as in the human brain, except in left BA45, where they were significantly larger in the human. The same region in the human (BA45) displayed lateralization in the form of larger minicolumns and lower GLI in the left hemisphere.

Our previous studies reported larger minicolumns in humans than apes, but were based on the left hemisphere. The current study and our previous examination of posterior BA22 (Tpt), which examined both hemispheres, found larger minicolumns in humans only in association with an asymmetry, raising the possibility that minicolumn size is similar in apes and humans except in regions with lateralization. This suggests that lateralization of minicolumns in human brains results from an enlargement of minicolumns in one hemisphere rather than a diminution in the other.

Lateralization in BA22 corresponds to increased spacing between interconnected cell clusters in a modular network in left BA22 in humans (Galuske et al., 2000). The extent to which this also occurs in Broca's area requires further investigation. We have yet to detect left-right differences in minicolumn spacing in a non-human primate brain.

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How pathological is the Nariokotome boy KNM-WT 15'000 (*Homo erectus*)?

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KNM-WT 15'000 is the most complete skeleton of a *Homo erectus* and generally of an early hominid and is therefore a key fossil for understanding human evolution. It belongs to an 11-15-year-old boy who lived 1.5 million years ago in area of Nariokotome at the shore of Lake Turkana (Kenya). Recently, a number of pathologies have been recognized, such as kyphoscoliosis and associated pelvic, rib and clavicular asymmetries, spina bifida, diminutive and platyspondylic vertebrae, condylus tertius, and neural canal stenosis. Based on these observations Latimer & Ohman (2001) suspected an axial dysplasia. The presence of such a severe congenital pathology would challenge current knowledge of the biology and behaviour of *Homo erectus* that is founded on this important skeleton.

In the present study, the fossil is compared to the normal variation of subadult modern humans as well as to scoliotic spines in order to analyse whether the skeleton of KNM-WT 15'000 is in fact pathological. Critical is the distinction of normal and pathological morphology, particularly in view of the juvenile age of KNM-WT 15'000. We show that the diagnosis of a congenital dysplasia is not justifiable. Indeed, most of the above features of the Nariokotome boy fall within the normal human variation. There are, however, indications of a possible disc herniation at the lower lumbar spine.

A comparative study of the growth and morphology of the Singapore Macaques (*Macaca fascicularis*)

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Although the variability in macaque morphology has been well described in the primatological literature, to date, little research has been published on variability in growth patterns in a single species of macaque. The purpose of the present study is to investigate differences in growth and adult morphology in two geographically distinct wild populations of crab-eating macaques (*Macaca fascicularis*) from Singapore (N=76) and Thailand (N=49). The results of our comparison of these populations indicate there are profound differences between these two populations in male and female growth patterns resulting in statistically significant differences in adult body weight for both males ($t=7.956$, $P<0.001$), and females ($t=8.393$, $P<0.001$). Significant differences in adult body length, cranial length and breadth are also found for both males and females, with the Singapore macaques exhibiting smaller dimensions. Interestingly, although the Singapore adult male macaques exhibit lower mean testicular volume than the Thai adult males ($t=1.883$, $P=0.089$), the Singapore males exhibit significantly greater testicular volume relative to body weight ($t=2.586$, $P=0.027$). The observed difference in relative testicular size may reflect differences between these two populations in levels of male-male competition, or some other aspect of social organization. This study is significant because it demonstrates there can be considerable variation in growth and adult morphology within a single species, suggesting statistical significance may not be a meaningful indicator of taxonomic differences. This research was funded in part by the University of Toronto's Connaught Fund.

Proportions of fiber types in intrinsic shoulder muscles of small primates and non-primate mammals related to forelimb protraction and loading.

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Primates protract their forelimbs to a greater degree during locomotion than other mammals. In order to balance the demands of increased mobility but required stability in the glenohumeral joint, many primates shift most of their body weight onto hindlimbs and thus, reduce forelimb's loading.

Differences in glenohumeral joint excursion and forelimb loading should be reflected by the percentage of fatigue resistant slow-twitch (SO) muscle fibers in shoulder muscles, which are responsible for the stabilization of the joint. To test this hypothesis, serial sections of the shoulders of tamarins, squirrel monkeys, slender loris, tree-shrews, and common squirrels were treated by enzymehistochemistry to differentiate muscle fiber types. Muscle fibers were counted on cross-sections of the shoulder muscles on six proximo-distal-levels from scapula to humerus midshaft.

In non-primate mammals, only supraspinatus muscles contained a distinct region of SO-fibers. In primates, most shoulder muscles showed an inhomogeneous fiber type distribution. In the infraspinatus muscle, the percentage of SO-fibers amounts up to 50 percent related to the muscle's role in preventing the hyperextension of the shoulder during forelimb's protraction. The overall highest percentage of SO-fibers was observed in the slender loris that showed the greatest amount of forelimb protraction and loading. The lowest percentage was found in the squirrel monkeys, which shift most of their weight onto the hindlimbs. Squirrel monkeys are the only species under study in which the humerus moves outside the scapular plane. This finding demonstrates the importance of the weight shift for the mobility and stability of the shoulder in primates.

Scaling of brain and body weight within modern and fossil hominids: implications for the Flores specimen

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The recently discovered hominid from Flores has a cranial capacity and body size approximating fossil australopith-

ecines. It has been argued that it is not pathological, but instead may represent some form of a *Homo erectus* endemic dwarf relic. While no modern analogs for endemic dwarfism exist in modern human populations, there does exist quite a large range of variation in brain/body sizes in populations that have presumably experienced a wide range of ecological environments selecting for varying brain and body sizes. Using Beals' cranial capacity and body weight estimates for 37 modern human populations, as well as Kappleman's (1996) estimates for a number of fossil hominids, the relationship between encephalization quotient (EQ) and body weight is found to be consistently negative within all hominid species (for which there were more than 2 data points). Within modern humans the correlation is r=-.74 (p<.0001, N=37); recent *Homo sapiens* fossil specimens r=-.95 (p<.0001, N=12), archaic *Homo sapiens* r=-.55 (p=.10, N=10); *Homo erectus* r=-.54 (p=.27, N=6); *Australopithecus boisei* r=-.998 (p<.05). These negative relationships indicate that brain size tends to decrease more slowly than body weight across specimens/populations. Flores brain/body values are not predicted by the relationships demonstrated for modern human populations, nor any of the fossil populations except the australopithecines. This suggests either that Flores underwent a wholly different kind of selection regime than any of the populations studied here, or it is pathological. The difficulties with uncritically using EQ as a measure of behavioral complexity will also be addressed.

Comparative morphometrics of chimpanzees and bonobos.

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Of the two closely related *Pan* species, the bonobo (*P. paniscus*) is typically described as being more gracile than the chimpanzee (*P. troglodytes*), and thereby a better potential "model" for early hominins. However, quantitative morphometric data to demonstrate this are scarce. Therefore, we set out to enlarge the existing morphometric dataset for chimpanzees and we add new comparative data of bonobos.

We collected morphometric data for 64 anaesthetised subjects (53 chimpanzees and 11 bonobos). Using a morphometric model (cfr. Crompton *et al.,* 1996) we obtained lengths and inertial properties (mass, position of the centre of mass, moments of inertia) for the upper and lower limb segments, the trunk and the head.
In chimpanzees, the head was proportionally larger than in bonobos. When considering the segments important for locomotion (i.e. fore- and hindlimb segments), our preliminary findings suggest that differences in absolute or relative segment lengths, masses and positions of the centre of mass between chimpanzees and bonobos are subtle.

Although our bonobo dataset comprised 11 individuals, a more extensive dataset is required to draw firm conclusions. Yet, this study demonstrates that differences between both species are more subtle than previously described.

The distribution of a Native American-specific allele.

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Because the evolutionary history of a population is the realization of several independent gene genealogies, it rarely can be reconstructed with data from a single locus. However, if a population event is accompanied by a genetic event, the locus of the genetic event affords a powerful resolution of the population event. Here we provide further evidence that a short tandem repeat polymorphism, identified by Zhivotovsky et al. (2003) as Native American-specific, is unique to and ubiquitous in Native Americans. We demonstrate that this Native American-specific polymorphism occurs at high frequencies in diverse populations and language groups throughout the Americas and discuss its implications for the peopling of the New World.

Characterization of a murder victim using stable isotopic analyses.

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In May, 2003 a semi-skeletonized body was found in a remote area of Mammoth Lakes, California, which had been partially disinterred from a shallow grave by bears. A coroner's examination showed that this was a 30 to 40 year old female murder victim who had been buried 6-9 months before discovery. A preliminary report suggested that she was a person of Southeast Asian ancestry based on her small stature (137 ± 5 cm) and dental morphology.

Isotopic analyses of her hair, teeth and bone were used to further characterize her cultural background and place of origin. Strands of hair 20 cm long representing about 1.4 years of growth gave δ13C values (base and end) of -14.3 ± 0.3 ‰, about 2 ‰ higher than the average for North Americans, indicating a maize-rich diet. Apatite of a premolar tooth (formed at ~ 6 years) gave δ13C = -4.6 ‰, indicating a diet extremely rich in maize; both values suggest a Mexican or Mesoamerican cultural background, not Asian. Oxygen isotope analyses of apatite should reflect δ18O of local drinking water which varies geographically. δ18O of the premolar tooth is consistent with a childhood in Southern California or Arizona, while δ18O of a rib (average of last 10 years of life) was 4 ‰ higher, consistent with S. Mexican or Guatemalan origin. These data indicate an origin in Southern Mexico or Mesoamerica that is consistent with independent craniometric and DNA evidence.

Across the ecological divide: Dental developmental diversity in Madagascar's giant lemurs.

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We summarize our research on the dental microstructure of subfossil Malagasy lemurs. By combining microstructural analyses of teeth with analyses of somatic growth and dental development, we are able to address questions never before asked of extinct lemurs: How dentally precocious were they at birth? When did M1 erupt? How long was gestation?

Standard histological sections (n>50) were prepared from teeth representing living indriids (*Propithecus, Indri*), lemurids (*Varecia, Lemur*) and the fossil species *Megaladapis edwardsi*, *Palaeopropithecus ingens*, and *Archaeolemur majori*. M1s initiate early in *Palaeopropithecus* (187 days prior to birth), as in indriids (94 days in *Propithecus*), and erupt at 2-6 months of age. M1 crowns are also accelerated, though not to the same degree, in *Megaladapis*, starting 132 days prior to birth and erupting ca. 9-13 months postnatally. *Archaeolemur* initiates and erupts its M1 relatively late (85 days before birth, and at ca. 15-19 months, respectively). Reconstructed gestation lengths are not short: 9-11 months for *Palaeopropithecus*, 8-9 months for *Megaladapis*, and 5-6 months for *Archaeolemur*. Our data underscore a remarkable diversity of developmental patterns in subfossil lemurs. Development in *Palaeopropithecus* is like that of indriids: slow somatic growth and fast teeth. *Megaladapis* also shows rapid dental development, but is less precocious at birth. Developmental schedules in *Archaeolemur* are reminis-

cent of lemurids: relatively rapid somatic growth and slow dental development. It appears that giant lemurs with relatively *rapid* dental development (*Megaladapis* and especially *Palaeopropithecus*) experienced relatively *slow* brain growth, and the opposite for species with relatively slow dental development (*Archaeolemur*).

Recognizing contrasting lifestyles in Medieval England.

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Previous research demonstrates that males from past populations appear to have been more sensitive to environmental stressors than were their female counterparts. Based on these findings, four male population samples from medieval England were compared to assess their bio-cultural environment based on their statures, body proportions, and skeletal pathology prevalences. The bio-cultural environment is defined as the combination of, and interaction between socio-economic status, nutritional status and health status, i.e., the inferred lifestyle. The samples come from: Fishergate, York, a Gilbertine monastic cemetery; St-Helen's-on-the-Walls, York, an urban parish cemetery; Towton, North Yorkshire, a battlefield mass grave from the Wars of the Roses (dating to the latter half of the 15th century); and Chichester, West Sussex, the cemetery of a medieval *leprosarium* and almshouse. Results suggest that these samples belong to four distinct social groups identified in previous research.

This assessment of the bio-cultural environment based on selected physical parameters of the four samples was compared with their inferred social status as determined from archaeological spatial relationships and historical information. It was found that an assessment based on physical parameters complements and adds to a purely archaeological/historical assessment.

The phylogenetic and functional utility of mandibular depth and maxillary height.

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The phylogenetic affinities of the Asian fossil primate families Eosimiidae and Amphipithecidae have been debated since their initial description. These specimens are often described as anthropoids, primarily based on dental characters. Two additional features, deep mandibles and vertically tall ("deep") maxillae, have also been identified as important non-dental characters that align these specimens with Anthropoidea. Both characters were used in recent descriptions of new taxa and have been included as qualitative characters in cladistic analyses of anthropoid relationships; they have also been discussed from a functional perspective. For example, a new eosimiid taxon, *Phenacopithecus krishtalkai*, was determined to be diurnal on the basis of a tall maxilla.

This study quantitatively investigated the phylogenetic and functional utility of mandibular depth and maxillary height. Two mandibular depth indices (MDI) and a mandibular height index (MHI) were devised and compared among 46 extant and fossil primate genera. While these indices separate living anthropoids from other extant primate taxa, there is no separation when fossil taxa are included. Therefore, fossil specimens can not be confidently placed into Anthropoidea on the basis of MDI or MHI values.

Mandibular depth and maxillary height were also analyzed for functional significance. As previously noted by many authors, relatively deep mandibles are associated with greater degrees of symphyseal fusion and/or tougher diets. Maxillary height seems indicative of activity pattern among haplorhine primates only, with large MHI values associated with diurnality among extant taxa. The MHI value calculated for *P. krishtalki* suggests this taxon was diurnal, as originally described.

What does the A.L. 333 sample tell us about sexual dimorphism in *Australopithecus afarensis*?

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Most studies of skeletal variation in *Australopithecus afarensis* suggest that this hominin was characterized by a high level of body size dimorphism. This view was challenged by a recent study, which concluded that previous estimates of dimorphism in this early hominin are in error and that *A. afarensis*—as represented by the A.L. 333 postcranial material—is similar to modern humans in its degree of skeletal dimorphism. However, the data set used to make this claim is problematic due to the fact that some of the individuals represented in the A.L. 333 assemblage probably contributed multiple specimens to the sample. This situation results in estimates of dimorphism that are biased toward monomorphism and an improperly inflated level of statistical confidence in inferences derived from the sample.

The analysis reported here examines the statistical confidence of estimates of dimorphism derived from the A.L. 333 sample. The data set is reduced from n=22 (the total number of specimens) to n=7 and n=11 by grouping similarly sized specimens into "individuals," and confidence limits are generated using the bootstrap. In addition, the methods commonly used to infer dimorphism in fossil samples are evaluated in order to document possible bias in the estimates. The results indicate that the potential degree of uncertainty in estimates of dimorphism for *A. afarensis* based on the A.L. 333 sample probably does not allow for specific statements regarding which living member of the African ape-human this extinct hominin most resembled in terms of skeletal dimorphism.

Habitat score: inferring hominid paleoenvironments based on equid and bovid metapodial morphology.

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Ecomorphological analyses of bovid femora, metapodials, and astragali all seek to reconstruct habitats available to various hominids. However, elements that are common in the fossil record are not always the most informative ecomorphologically. Bovid metapodials, for example, while informative with respect to habitat preference, are typically very fragmentary at important fossil sites. In contrast, hipparion metapodials tend to be well preserved. Unfortunately, no large extant radiation of equids is available for comparative study.

Here a bovid analog was used to model hipparion metapodial morphology and habitat preference. Analogous measurements were taken on bovid and hipparion metapodials and canonical variates were computed for plains and forest bovids on the basis of residuals of these measurements versus skeletal size. An independent test of this model was made using light cover and heavy cover bovids. The first canonical variate summarized relative metapodial elongation and slenderness and was the main correlate of habitat. The equation for this canonical variate was next applied to residuals for a large sample of fossil hipparions. This variable was useful for placing bovids and fossil equids on a continuum from open/dry to closed/wet habitats and is proposed here as a habitat score.

Resulting habitat scores for bovids increased across a habitat continuum from more closed habitats to more open ones. Similarly, hipparion habitat scores ranged from low for forest forms (e.g., Höwenegg) to high for plains forms (e.g., La Roma). When applied to hominid sites, habitat scores from Can Llobateres, for instance, confirm a more forested paleoenvironment for *Dryopithecus*.

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Do early South Americans show biological similarity to Australians?: Lagoa Santa in odontometric and craniometric perspective.

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In this study, odontometric and craniometric data are used to assess the similarities and differences between the Brazilian Paleoindian Lagoa Santa and major population groups of the world. Neves (1991, 2003, 2005) suggest that Lagoa Santa is more closely related to Australian Aborigines than Native Americans and Northeast Asians using Howells' worldwide comparative craniometric dataset. On the other hand, in our previous study we concluded that Lagoa Santa individuals exhibit close craniometric affinities with Archaic Indians of North America and the prehistoric Jomon of Japan, and do not show a resemblance to Australians.

Using odontometric data we obtained results that support our previous craniometric study. First, it is well-known that human tooth size underwent a reduction during the Late Pleistocene and the Holocene. The total dental size of modern Australians is much larger than Lagoa Santa. Second, the tooth size profiles of the Early Jomon are similar to Lagoa Santa except for the canines. Third, the profiles of cross-sectional areas of each tooth show that Lagoa Santa exhibits closer affinities to Tierra del Fuego, Michigan Native Americans and Polynesians which can be Jomon-derived groups rather than to Australians and Melanesians. Fourth, the results of multivariate statistics indicate that Lagoa Santa is closer to Michigan Native Americans and Tierra del Fuego than to Australians. Using both odontometric and cranioimetric data, our results suggest that Lagoa Santa is derived from the inhabitants of Northeast Asia during the Late Pleistocene including the ancestors of the Jomon and not from Australia.

An historical skull collection and its use in forensic odontology and anthropology

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The Institute of Forensic Medicine, Copenhagen, houses a collection of historical skulls of unclear origin, marked with a general geographic or "racial descriptor". Would these historical skulls be of any value for the forensic odontologist and anthropologist concerning teaching and casework? We tried to clarify this question by recording non-metric dental traits and by performing craniometric analyses.

A morphological and morphometric investigation of anatomical/dental traits in 80 adult skulls was performed. For each skull we recorded four non-metric dental traits using the ASU-System and three non-metric cranial traits. Nineteen cranial measures were also taken following the FORDISC programme manual. The non-metrical data were tabulated as frequencies, and the metric data was entered in the FORDISC programme. Observed non-metric trait frequencies were compared with published data. The FORDISC programme computed a discriminatory analysis for each skull and thereby assigned the skull to the most probable ethnic category.

The results for the non-metric traits showed that the traits generally followed the expected frequencies in 80 % of the cases. The FORDISC programme correctly assigned ethnicity based on skull measures in overall 70% of the cases.

Coevolution of human lactation, complementary feeding, foraging and life history.

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Comparative data on lactation biology are used to test the hypothesis that use of "complementary" foods specially collected and processed for juvenile consumption is a species-typical, derived characteristic of humans. Although limited, they suggest that three ancestral adaptive advantages of lactation (infant immune protection, infant nutrition, maternal fertility regulation) are retained. There is no cogent evidence for additional derived features of human milk (significantly altered fatty acid content to support brain growth) or mammary glands (signaling residual reproductive value). Humans need breast milk for optimal growth and development, just like any other mammal.

However, humans have evolved a uniquely flexible and comparatively less costly strategy for feeding. Individuals are weaned at a relatively wider range of weights and ages relative to adult body size and age at maturity and weaning weights tend to be low relative to birth weight. The pattern of postnatal "transitional" feeding is distinctive, and complementary feeding appears to be unique among extant mammals. Only humans have evolved the capacity to keep young alive without consumption of any maternal milk, a biocultural innovation that has eroded breastfeeding practice below physiologically healthy and previously adaptive thresholds.

Conclusions are that complementary feeding evolved as a facultative strategy for resolving tradeoffs between maternal costs of lactation and risk of poor infant outcomes. It increased hominid maternal fertility by accelerating the transition to weaning without decreasing offspring survivorship. Future research should focus on understanding where in the hominid clade this key adaptive shift occurred.

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HPLC identification of major oxytocin metabolites in primate urine – a radiolabeled study.

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The role of oxytocin in the governance of social phenomena such as pair bonding, sexual behavior, and conspecific recognition has been examined in a number of species. Its function in regulating the social behavior of humans and nonhuman primates, however, is not well understood. This is partly because typical sampling methods (cerebrospinal fluid taps and blood draws) are sometimes considered too invasive for these species, whereas non-invasive techniques have not proven consistently successful in recovering this molecule intact and in sufficient quantity for measurement. To address this problem, a radiolabeled study was performed on four (4) male common marmosets (*Callithrix jacchus*) in order to determine whether or not oxytocin is breaking down into urinary metabolites, and whether or not these metabolites can be measured in lieu of oxytocin itself via a non-invasive assay.

Ten (10) microcuries of tritium-labeled oxytocin were injected intravenously into each subject. For a 48 hour period, all urine was collected and then subjected to extraction and HPLC fractionation. Two major metabolites were identified via analysis of these fractions for presence of the radiolabel. Intact radiolabeled oxytocin was also recovered, corresponding to the retention time of pure oxytocin, with changes in concentration correlating strongly ($r \approx 0.93$) with metabolite concentrations. We conclude that oxytocin metabolites are measurable in the urine of this species, and also that HPLC analysis is an effective methodology for measuring them accurately. This may prove instrumental to endocrine studies of human and nonhuman primate social behavior.

Work supported by the American Primatological Society, Small Research Grant to L.J.S., MH70423 to T.E.Z. and RR000167 to the Wisconsin National Primate Research Center.

Measuring tooth diameters at the cervical margin to minimize the effects of wear: A test.

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This study evaluates a largely untapped method to minimize the effects of tooth wear and maximize sample size in studies of tooth crown diameters. Metric dental traits have a high heritable component, and can be used to measure biological distance between different populations (Jacobi, 2000). They also allow characterization of dental sexual dimorphism, as males have teeth that are two to six percent larger teeth than females' (Scott and Turner, 1997). However, tooth wear modifies the original size and shape of teeth, and must, therefore, be identified and controlled for. As a result, teeth with marked occlusal or approximal wear are excluded by most researchers from metric analysis, greatly reducing sample sizes (Hillson, 1996).

An alternative method involves measuring mesiodistal and buccolingual diameters at the cervical margin. This technique has been shown to minimize the effects of wear and yields similar results (Colby, 1996; Falk and Corruccini, 1982; Goose, 1963; Hillson, 1996). Both the alternative and more standard techniques were applied to a sample of Mayan dental remains representing 50 individuals to determine if they yielded similar results. Ancient Mayan skeletal remains are often very poorly preserved, limiting their usefulness for measuring biological distance. Thus, this study has the important implication of maximizing sample size, which applies to studies of fragmentary human remains in general.

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The paleobiology of the robust australopithecines (*Paranthropus*): a preliminary test of the durophage model using carbon isotope analysis.

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The durophage model reconstructs the robust australopithecines (*Paranthropus*) as opportunistic consumers of hard-shelled invertebrate prey in wetland and mesic ecosystems. Here I report an empirical test of the model with a carbon isotope analysis of two mammalian analog taxa (the marsh mongoose *Atilax paludinosus* and the clawless otter *Aonyx capensis*) and their preferred prey (freshwater crabs of the family Potamonautidae). First, I detail the natural history of this food web and the structure of modern African wetland ecosystems. Then, I examine the evidence for the distribution of these ecosystems during the Plio-Pleistocene, and I summarize the fossil evidence for the distribution of *Atilax* and *Aonyx* (both are known from Olduvai and Swartkrans) and for the freshwater crabs (known since the Miocene). Finally, I present carbon isotope data for freshwater crabs from six southern African localities, including the sites of Swartkrans and Taung (crabs are abundant in the wetlands adjacent to these sites). The mean $\delta^{13}C$ value of crab muscle tissue from the Transvaal region was -20.98‰ (sd=1.88, n=56). A preliminary analysis of bone collagen from *Aonyx* and *Atilax* yielded a mean $\delta^{13}C$ value of -16.35‰ (sd=1.17, n=12) as would be expected for animals feeding predominantly on crabs. When compared to the published $\delta^{13}C$ values for *Paranthropus* dental enamel (x=-7.62‰, sd=1.13, n=18), it is evident that the durophage model has not been falsified. In conclusion, in light of all evidence, I address the question of whether the robust australopithecines are better conceived as ecological specialists or generalists.

Long bone robusticity and behavioral variability in the Inuit sample from Point Hope, Alaska.

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Because of the demands of an Arctic foraging existence, the Point Hope Inuit skeletons have been considered robust relative to other human samples. Cross-sectional properties (J, Ix/Iy) of the humerus and femur were analyzed to assess the robusticity of this sample. Males and females were evaluated in the context of five additional Holocene and recent human samples that represent a wide range of cultural and environmental conditions (Jomon Japanese, Andaman Islanders, Libyan nomadic herders, Predynastic Egyptians, recent East Africans).

Humeral robusticity in Point Hope is relatively high, and it is consistent with samples engaged in strenuous upper body activity (Andaman Islanders). However, robusticity in this sample is significantly lower than in other highly active hunter-gatherers (Jomon). Between-group differences are greater in females than in males. Point Hope is distinguished by an antero-posteriorly reinforced distal humeral section.

The Inuit sample demonstrates significantly greater robusticity in midshaft and proximal femoral strength than all other samples, with females again showing greater between-sample differences. Most distinctive, however, is the distribution of cortical bone at the proximal femur with the Inuits having a significantly lower average ratio of second moments of area than all other samples, representing a mediolaterally-broad proximal section. Given the relationship of this section with body breadth, this value is more likely correlated with body shape than habitual activity. Although levels and patterns of activity suggest that Point Hope was a highly active population, additional environmental factors also contributed to differences in the robusticity of this population.

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A preliminary survey of the primates in the Upper Essequibo Conservation Concession, Guyana.

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Guyana offers tremendous opportunities for primate conservation, as it retains over 80% of its original forest and harbors at least 9 species of primate. Unfortunately, these forests are almost completely unprotected. In an initial step toward establishing a protected areas system in Guyana, Conservation International created the 81,000 hectare Upper Essequibo Conservation Concession in 2002.

In July 2005, I conducted surveys in the concession to establish which primate species were present and estimate their abundance. I walked transects, conducted boat surveys along the Essequibo River and several creeks, and interviewed local people. I surveyed approximately 167 km during the study period (88km during land surveys and 79km during boat surveys).

I observed 22 primate groups (11 during land surveys and 11 during boat surveys) representing 8 species. The total sighting rate was 1.32 groups/10km. The most frequently encountered primate was *Alouatta seniculus macoconnelli* which accounted for 27% of groups observed. *Chiropotes satanas chiropotes* (18% of total groups) and *Cebus apella apella* (14% of total groups) were also commonly observed. I only sighted one group of *Pithecia pithecia pithecia*. These results were consistent with estimates of primate abundance provided by local people.

Guyana's primates are relatively unstudied and these data are the first reported on the primates of the Upper Essequibo Concession. Individual species and total sighting rates are fairly high compared to those reported from other sites in Guyana, suggesting that the concession is an excellent site for future research on Guyana's primates and for their conservation.

What the stone tools can (and can't) tell us about hominin evolutionary relationships.

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The similarity of the stone tool industries associated with morphologically-different hominins has been seen as evidence for contemporaneity, cultural interactions, and even biological continuity. This interpretation treats Paleolithic industries as if they are the functional equivalent of ethnographic and recent archaeological "cultures". They are not. Paleolithic industries span time periods and geographic ranges orders of magnitude greater than any known historical or ethnographic culture. Unlike recent human cultures, most of the named Paleolithic industries were defined on the basis variation in a single dimension of material culture, technological and typological variation among stone tools. Most Paleolithic stone tools are technologically simple (few require more than a few minutes effort by a skilled flintknapper). Consequently, there is an intrinsically high likelihood of "convergence" among the lithic archaeological records of closely-related hominin species. Similar stone tool industries associated with morphologically-different hominin fossils may signal ecological overlap, or competition for the same niche. A further difficulty is that most linkages between particular hominins and stone tool assemblages are usually inferred from burials (stratigraphically intrusive features), assemblages that formed over prolonged periods, or cave sediments with complex geological and taphonomic histories. In principle, it may be possible to infer patterns of hominin cultural variation from the Paleolithic record, but the methods archaeologists use to describe stone tool variation are not yet adequate to do this.

Taxonomy and biogeography of Eastern Tarsiers.

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Niemitz (1984) classified tarsiers from Sulawesi and surrounding island groups—animals that I refer to herein as Eastern Tarsiers—into a single species, *Tarsius spectrum*, with two subspecies, *T. s. spectrum* and *T. s. pumilus*. Just prior to Niemitz's taxonomy, however, MacKinnon and MacKinnon (1980) wrote "there is clearly much more taxonomic work to be done to sort out the Sulawesi tarsiers", based on their observations that these tarsiers possess a duet call that shows geographically-structured variation and that museum skins appear to show geographically-structured variation when organized by acoustic form. Niemitz and others followed up on these observations, and results of field surveys indicate that Niemitz's *T. s. spectrum* is organized into at least 16 discrete acoustic forms, each of which is hypothetically a distinct taxon. The distribution of these acoustic forms points toward a biogeographic hypothesis that offers a compelling synthesis between two seemingly incompatible biogeographic hypotheses—based on geological and biological data, respectively. Tarsier genetic data confidently reject the previous biogeographic hypotheses to explain patterns of tarsier genetic variation, but cannot reject the new hypothesis using the Templeton test. Discriminant function analysis of tail-tuft shape provides quantitative support for the MacKinnon's assertion that tarsier morphology shows geographically-structured variation when organized by acoustic form. Thus, genetic and morphologic data are broadly compatible with the hypothesis that Eastern Tarsier acoustic forms are discrete taxa. The process of revising tarsier taxonomy to reflect this will take years, given the lack of holotypes for key taxa and many putative new ones.

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Play behavior among wild, maturing male chimpanzees at Ngogo, Kibale National Park, Uganda.

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Play behavior is common among immature primates, and it has been theorized that play is important for the behavioral development of young primates. Maturing chimpanzees spend a lot of time playing each day and males usually play more than females. However, few data exist about the variation in play behavior, relative to developmental stage, in wild chimpanzees. Here, I present data on play behavior among maturing male chimpanzees, focusing on most frequent play partners, developmental stage and dominance rank.

I conducted research at Ngogo, Kibale National Park, Uganda. The Ngogo chimpanzee community is the largest on record, with a total of about 140 animals. During my study I focused on twenty-three males, including all of the adolescents in the community, six young adult males and two, apparently, orphaned juvenile males. I collected data during all day follows of mixed age-sex parties. I used focal, scan and *ad libitum* methods to collect data on play behaviors.

Results indicate that; individuals are selective in their choice of play partners, age has a significant effect on play behavior while relative dominance rank does not. Controlling for associations, maturing males had preferential play partners. Juvenile and early adolescent males played significantly more than middle or late adolescents. Finally, dominance rank had no measurable effect on play behavior. These results indicate that play behavior is more important for younger males than it is for older males. It appears that as males age they devote more of their time to competing for dominance and mating opportunities.

Quantitative genetics of modern baboon (*Papio hamadryas*) craniofacial variation.

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The primate craniofacial complex is an integrated structure composed of several developmental and functional components. During ontogeny the three primary components, the neurocranium, splanchnocranium, and basicranium, are vulnerable to genetic and epigenetic influences, often showing a coordinated response to those influences. Previous work with human data has demonstrated a significant heritable component to quantitative variation in measures of craniofacial morphology at various stages of development. However, the magnitude of genetic influences, and the nature of the correlated effects of genes, on normal variation in these three craniofacial regions within nonhuman primates have yet to be elucidated.

To examine the genetic underpinnings of the structure and development of the primate craniofacial complex, twenty-one craniofacial measures were taken from lateral cephalograms of 304 baboons at the Southwest National Primate Research Center, San Antonio, TX. Two subspecies, *Papio hamadryas anubis* and *P.h. cynocephalus*, and their hybrids were included. All animals ranged in age from 2 to 8 years at the time of examination. Heritability (h^2) of each trait, as well as the additive genetic correlations (ρ_g) between traits, were estimated using a maximum likelihood method for pedigree data. All heritability estimates were significant, ranging from 0.15 - 0.99. Genetic correlation analysis identified varying degrees of pleiotropic effects on craniofacial traits. Future work will seek to identify the specific genes influencing variation in the morphology of the baboon craniofacial complex.

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Genetic mapping of natural variation in the teeth of recombinant inbred mice.

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The prevalence of teeth in the fossil record and their use in establishing primate taxonomic relationships has led to their importance in anthropology. Understanding the genetic basis of dental patterning enhances our ability to interpret morphological variation in primates. Work among humans has identified genes involved in dental dismorphology, but, due to the limitations of primates as model experimental organisms, little is known genetically about the many subtle but adaptively important aspects of natural dental variation. Here we use a mouse model to investigate the genetic basis of the kinds of natural dental variation seen in primates and in the fossil record. Information gained from the mouse relates directly to primates because of the conservation of genes and signaling pathways through evolution.

We identify a dental variant resembling variation among primates between the upper second molars of two inbred strains of mouse, C57BL/6j (B) and A/j (A). Genetic mapping using 25 AXB/BXA recombinant inbred strains of mouse, each derived from a cross of B and A mice followed by inbreeding, identified regions on mouse chromosomes 11, 13, and 19 associated with the dental variant. From the genes in these regions we identified several candidates through prior knowledge of dental genetics, gene expression data, and sequence variation between A and B mice. This analysis suggests a possible role in natural dental variation for *Dlx3*, associated with trichodentoosseous syndrome causing enamel hypoplasia and dental patterning, *Dkk1*, involved in tooth crown patterning and enamel formation, and *Barx1*, a determinant of molar tooth identity.

Determinants of tubal ligation in Puebla, Mexico.

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In the state capital of Puebla, Mexico, women aged 40-60 were recruited from open air markets and city sidewalks to participate in a study of age and symptom experience at menopause. Contraceptive use and history of tubal ligation were queried as part of that study. Of the 755 women surveyed, 42.5% had undergone a tubal ligation at a mean age of 32.9 years (s.d. 5.4, range 18-50). This frequency, very similar to the rate of female sterilization reported for Mexico as a whole, provides an opportunity to examine the determinants of tubal ligation within this population.

Univariate analyses indicate that women who were single or divorced at interview were significantly less likely to report having undergone a tubal ligation (18.3% and 28.3%, respectively) compared with married women (49.5%, $p<.01$). Frequencies of tubal ligation increased with increasing parity up to 7 children – 0 children (3%), 1 child (11%), 2 (36%), 3 (51%), 4 (50%), 5 (60%), 6 (60%), 7 (59%). Women with 8 or more children reported fewer tubal ligations (40%). In separate logistic regression analyses, younger age at first birth and higher socioeconomic status were significant determinants of tubal ligation ($p<.01$). Age at last birth, level of schooling, and use of other contraceptive methods were not significant determinants. When all variables were examined by logistic regression analysis, parity and marital status remained significant. Cox regression analyses will be utilized to examine these and other variables in relation to the risk of tubal ligation by age.

Upper incisor evolution in plesiadapiform primates.

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Morphology of the upper central incisors has been stressed as being of particular importance in early primate systematics. The simple conical form of the I1 in the microsyopid *Megadelphus* has been contrasted with the more complex I1 of plesiadapids, saxonellids, carpolestids, paromomyids, and micromomyids, in which the tip is divided into two or more apical cusps, and there is a cusp near the base of the crown (posterocone). Thus, it has been argued that microsyopids were only distantly related to (other) plesiadapiforms. The presence of an apparent synapomorphy linking non-microsyopids plesiadapiforms, which is absent in euprimates, was also seen as cause to doubt a euprimate-plesiadapiform relationship.

Recent recovery of I1s from other microsyopids demonstrates that the morphology of *Megadelphus* is not typical of the family. While no known microsyopid has an apical division of I1, in both *Niptomomys* and *Berruvius* I1 bears a posterocone. In these taxa I1 is similar in general form to the very simple I1s of the basal plesiadapoids *Chronolestes* and *Pandemonium*. These new microsyopid and plesiadapoid specimens demonstrate that a simple model of incisor evolution is no longer feasible for plesiadapiforms. When optimized on a cladogram based on 173 dental, cranial, and postcranial characters, the form of the I1 shows extensive homoplasy, with the evolution of an apical division occurring at least three times in early primate evolution. Thus, recent claims that the enlarged, multicuspate incisors of certain plesiadapiforms are clear evidence against a plesiadapiform-euprimate link are in need of re-evaluation.

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Disease patterns and nutritional status of populations from protected areas in the Brazilian Atlantic Forest: Are human health and environmental preservation linked?

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In most rural areas of the Brazilian Atlantic Forest (AF) poverty and environmental degradation are rampant. However, the health effects of these factors on human populations have not yet been investigated. Using an ecosystems health approach, different economic, socio-ecological and health characteristics of the populations living near three protected areas in Espírito Santo state, Brazil, were investigated in order to understand the complex relations between humans and their environment in the AF, and to facilitate the conservation of protected areas. A total of 178 families participated in the research. The study population is experiencing an epidemiological transition characterized by continued high levels of infectious diseases such as intestinal parasites, which infect 23.2% of individuals and diarrhea, which affects 10.5% of children below five years of age, a high fertility rate (2.2%/yr), and growing levels of chronic diseases, including overweight (19.8%), obesity (9%), and hypertension (13.4%). High levels of acute diseases among children are related to low socio-economic status and poor sanitary infrastructure, while a reduction in physical activity levels, dietary modification and increased dependency on the market economy appear to particularly impact the adult women, who show a higher prevalence of chronic diseases compared to men ($p>0.05$). Previous research has shown that populations undergoing intense socio-ecological stress are likely to develop antagonistic relationships with protected areas as these cannot be used for their economic activities. This study supports the hypothesis that it is not possible to protect the environment without taking into account the health situation of the local populations.

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Assessing the relative contribution of the EDJ and enamel cap to the occlusal morphology of molar tooth crowns using microCT and GIS.

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Occlusal surface morphology of the tooth crown carries functional, taxonomic and phylogenetic information. The development of this surface can be simplified into two, somewhat distinct, processes: formation of the enamel-dentine junction (EDJ) and overlying deposition of the enamel cap. Understanding the relative contribution of each process to features of crown morphology will improve interpretations of their variation as well as identifying the most appropriate surface of study [e.g., EDJ or outer enamel surface (OES)] for particular research questions.

This paper presents the results of a pilot study that uses microCT scanning and GIS software to assess the relative contribution of the EDJ and OES to surface morphology of the occlusal basin. MicroCT scanning provided high-resolution 3D surface data of the EDJ and OES of mandibular and maxillary molars from modern humans and a small sample of hominoids. GIS software was used to quantify surface orientation (i.e., facing mesially, buccally, etc.) and surface slope for both the EDJ and OES. EDJ data, either orientation or slope, were then subtracted from the OES data in order to determine their relative contribution to each aspect of occlusal basin morphology.

The results indicate that the orientation of occlusal basin morphology is largely established early in development with the growth and folding of the inner enamel epithelium, while the slope of the occlusal basin morphology is established later in development with the formation of the enamel cap. Variations in this pattern between upper and lower molars and with differences in enamel thickness are discussed.

Mitochondrial DNA variation within and among regional populations of the *fascicularis* group of macaque species.

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An 835 base pair sequence of mitochondrial DNA, including the first hypervariable segment of the control region, was used to characterize genetic variation within and among samples of five regional populations of longtail macaques (*Macaca fascicularis*) and one sample each of Japanese (*M. fuscata*) and Taiwanese (*M. cyclopis*,) macaques.

The mtDNA haplotypes of longtail macaques clustered into two large highly structured reciprocally monophyletic clades (Fas1 and Fas2) of a neighbor-joining tree that were quite divergent from those of rhesus macaques (*M. mulatta*) from five different countries that were also studied. Both clades exhibited haplotypes of Indonesian and Malaysian longtail macaques widely dispersed throughout them, but a well-defined subclade of Fas1 contained all Indochinese haplotypes and two different well-defined subclades of Fas2 contained all haplotypes from Mauritius and the Philippines, respectively.

Longtail macaques from Malaysia and Indonesia were far more genetically diverse than those from Indochina, the Philippines and, especially, Mauritius. Nucleotide diversity between mtDNA sequences of longtail macaques from different geographic regions is nearly as great as that between Indian and Chinese rhesus macaques. Rhesus macaques from China were more closely related to both Taiwanese and Japanese macaques than to rhesus macaques from India. Approximately equal amounts of genetic diversity is due to differences among animals in the same regional population, different regional populations and different species. The results of this study support the inclusion of Japanese and Taiwanese macaques in the species *M. mulatta*.

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Problems with species identification in the human fossil record with special emphasis on the Neandertal question.

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Despite many forceful statements to the contrary, the identification of species units in the human fossil record continues to be a difficult undertaking. Many paleoanthropologists utilize some variation of G.G. Simpson's evolutionary species concept (ESC), which defines species on the basis of morphology that reflects reproductive exclusivity so that the species (lineage) maintains its identity from other lineages and has definitive evolutionary tendencies and a unique historical fate. Using Neandertals as an example, we show that identifying such traits is not simple, and that while much of the Neandertal morphological pattern is distinctive and may meet the ESC criteria, there are anatomical details (e.g. occipital bunning, upper midfacial projection, suprainiac fossae, aspects of mandibular form) that probably do not. We evaluate the problems with these features (definition, genetic basis) and note that the same problems characterize the general cranial form that is widely accepted as defining modern humans. In addition to morphological details that may demonstrate Neandertal contributions to early modern humans in western Eurasia, we identify a broad "hybrid zone" extending from North Africa to central Europe. We conclude that the available evidence, including ancient DNA and extant human genetic analyses, are most commensurate with an "extinction by swamping model" in which Neandertals are genetically and demographically swamped over a period of several thousand years by modern populations with markedly superior numbers. This type of "extinction" is common in the biological world, and it calls into question whether the ESC is applicable to Neandertals.

Paleopathology of the 1856 Neandertal: new data, new insights.

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The recent discovery of, and excavation in, deposits removed in 1856 from the Kleine Feldhofer Grotte cave floor yielded further pieces of the original Neandertal skeleton (Neandertal 1) as well as evidence for a second adult and a single subadult. Paleopathological examination of this new material provides further insight into the quality of life of the European Neandertal. Traumatic injury is acknowledged to be common in the general Neandertal sample. Indeed, the Neandertal 1 remains of 1856 display significant elbow joint remodeling that is arguably traumatic in origin. The fragmentary remains of a second individual (Neandertal 2) also reveal forearm trauma underscoring the ubiquity of traumatic injury among Neandertals. But in addition to a likely debilitating traumatic injury, new fossil fragments indicate that Neandertal 1 had inflammatory responses to chronic pathological conditions which would minimally have caused discomfort, if not pain. Extensive periostitis of the maxillary and sphenoid antra indicates extreme chronic paranasal sinusitis. Additionally, if not as a corollary to the sinusitis, there is new dental evidence for chronic periodontitis. The health history of what is likely Neandertal 1 also suggests compromised growth and development. Linear enamel hypoplasia is present on newly recovered dentition.

Metacarpal fractures as a key to understanding culturally patterned violence in a historic urban cemetery sample.

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Physical manifestations of aggression vary considerably between cultures. Consequently, the type and distribution of injuries resulting from such hostility are similarly culturally specific. Using data derived from a historic cemetery, St. Martin's, England, we consider a pattern of violence related injuries in relation to modern clinical data and contemporary written and artistic sources. Particular consideration was given to the possibility of a relationship between types of violence regarded as socially acceptable and those that are popular in sport. Walker (1997), observed that a rise in facial injuries suggestive of fist-fighting in early 20th century America coincided with the growth in popularity of boxing. Contrary to Walker's opinion our research demonstrates that a pattern of injuries consistent with fist-fighting can also be discerned in 18th-19th century British populations. In particular, a large number of injuries to the hands (specifically the metacarpals) of adult males are argued to derive from punching in a style specific to bare-knuckle boxing. At St. Martin's a pattern of injuries is apparent which is both consistent and coincident with the adoption of boxing styles as the accepted 'manly' way of settling disputes. It is of further relevance that much of this sample represents a working class, urban population as opposed to the predominantly middle-class British samples previously studied. This research underlines the importance of considering data from skeletal analyses in their specific socio-cultural context in order to gain the maximum information on patterns of past behaviour.

Juvenile stature estimation using long bone lengths.

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Forensic anthropologists routinely estimate stature for adult cases, but stature estimation of juveniles is comparatively rare, and few published regression equations for juveniles are available for consultation when necessary (e.g., with commingled remains). Data from the Denver longitudinal growth study (31 boys and 36 girls) are utilized to produce combined-sex and single-sex least squares linear regression equations for the individual long bones of the limbs and for the summed femur and tibia lengths for 3-10 year old children. Measurements are of radiographic diaphyseal length (focal length = 228.6 cm).

Correlations between bone length and stature are high in all cases (r^2 range, 0.94 to 0.99), and F- and t-statistics indicate strongly significant results. Differences between sexes are, as expected, minor. Equations for stature (cm) for the combined-sex sample are as follows: Humerus, y = 0.4658(x) + 27.053 (S.E. = 3.00); Radius, y = 0.6229(x) + 27.500 (S.E. = 3.16); Ulna, y = 0.5898(x) + 23.742 (S.E. = 2.91); Femur, y = 0.2928(x) + 36.923 (S.E. = 2.46); Tibia, y = 0.3519(x) + 38.614 (S.E. = 2.24); Fibula, y = 0.3620(x) + 37.273 (S.E. = 2.24); Femur + Tibia, y = 0.1612(x) + 36.981 (S.E. = 1.97).

Comparative examples using tables previously published by Maresh (1970) to obtain "ballpark" estimates yield similar results, but the equations are easier to use and allow one standard error estimate for the mean. Testing of these equations is encouraged.

Inferring population continuity versus replacement with aDNA: a cautionary tale in the Aleutians.

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The Aleutian archipelago comprises a chain of volcanic islands extending 1,900 kilometers westward from the Alaskan peninsula, forming the Bering Sea/Pacific Ocean boundary. We studied mitochondrial DNA of 80 prehistoric Aleuts from three archaeological sites (Chaluka, Kagamil, and Shiprock) that span approximately 3500 years of Aleutian prehistory. Our aim was to test whether early (Pre-Aleut) and late (Neo-) Aleut populations represent a genetically continuous population or present evidence of a replacement as hypothesized by Hrdlicka (1945), and to assess the genetic affinity of ancient and modern Aleuts with other populations of the circumarctic. Mitochondrial haplogroups were identified using polymerase chain reaction (PCR) and restriction enzyme digestion. The exclusive presence of haplogroups A and D indicates that the Aleutian Islands were probably colonized from the East, since neighboring Siberians to the West have high frequencies of haplogroup C, as well as other mtDNA haplogroups absent in the Aleutians. Statistical analyses show that mitochondrial haplogroup frequencies of Pre-Aleuts are significantly different from those of Neo-Aleuts, suggesting prehistoric population movement, if not replacement. Moreover, modern Aleut mtDNA haplogroup frequencies are more similar to the later Neo-Aleut samples. This apparent temporal trend in haplogroup frequencies cautions against a strict interpretation of population continuity throughout the time frame investigated. These results are at variance with an earlier study based on a subset (n=36) of the full database described here. The disparity emphasizes the importance of sample size and direct dating of individual specimens in ancient DNA studies.

High resolution microtomography of Middle Stone Age human molars from South Africa.

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Recent technological advances in microtomography have made possible the non-destructive analysis of dental structures, including internal tooth morphology, with high resolution and accuracy. This study employs conventional and synchrotron microtomography to examine molar enamel thickness and volume, and the shape of the enamel-dentine junction (EDJ) in Middle Stone Age (MSA) human molars from the sites of Die Kelders Cave 1 and Equus Cave, South Africa. Enamel thickness and aspects of EDJ shape were characterized in virtual two-dimensional (2D) planes of section, analogous to those frequently used in histological studies. These data were compared to those from a sample of approximately 250 recent human molars. Enamel volumes were determined from microtomographic data after 3D segmentation, and were compared to data from published and unpublished sources.

When tooth type was accounted for, values of average and relative enamel thickness from the 2D slices were found to be within the range of recent human values, as were aspects of EDJ shape. Enamel volumes were also found to be similar to those of recent human molars. These results provide additional evidence for the similarity between sub-Saharan MSA and recent humans, and are consistent with previous observations that MSA human teeth are comparable to those of recent sub-Saharan Africans in terms of discrete morphological features. This study demonstrates several applications of virtual paleoanthropology, an increasingly important approach to the characterization and analysis of rare and valuable fossil remains.

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Ontogeny and functional histology of the first ethmoturbinal in strepsirrhines.

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Conventionally, maxilloturbinals comprise the "respiratory turbinals" whereas nasoturbinals and ethmoturbinals comprise "olfactory turbinals," denoting the primary type of mucosa that lines these conchae. However, the first ethmoturbinal (ETI) appears exceptional in its epithelial variability in primates, including taxa that possess the most primitive nasal fossae structure. The present study was undertaken to determine how the rostrocaudal distribution of olfactory epithelium (OE) versus non-olfactory epithelium (non-OE) scales relative to cranial length (prosthion-inion distance) in strepsirrhines. Serially sectioned heads of twenty strepsirrhines (15 neonates, 5 adults) were examined to map the location of OE and non-OE on ETI, rostral to its root (primary lamina). Based on known distances between sections of ETI, the rostrocaudal length of OE was measured and compared to the length lined solely by non-OE (primarily respiratory epithelium). In five specimens (3 neonates, 2 adults), the total surface area of OE and non-OE was calculated.

Results show that non-OE length scales nearly isometrically with cranial length, while OE is negatively allometric. Furthermore, non-OE length correlates more highly with cranial length (R = 0.88) than does OE length (R = 0.62). In surface area, the ETI of larger species had a greater percentage of non-OE than smaller species; adults had more non-OE% than neonates. Such results are consistent with recent suggestions that the olfactory structures do not scale closely with body size whereas respiratory structures (e.g., maxilloturbinals) scale close to isometry. In primates and perhaps other mammals, variation in ETI morphology may reflect dual adaptations for olfaction and endothermy.

Measurement of human pituitary hormones in dried blood spots by multiplex immunoassay.

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The anterior pituitary plays a critical role in reproduction, growth, and metabolic function through its secretion of hormones that act on target tissues throughout the body, including the adrenals, gonads, and thyroid gland. Although pituitary hormones can provide a wealth of information on human health and physiology, they are rarely included in population-based research because of the requirement of relatively large sample volumes (typically obtained by venipuncture), and difficulties related to the storage and transport of plasma, serum, or whole blood samples. The development of Luminex multi-analyte profiling (xMAP) technology helps remove these obstacles by allowing for the simultaneous measurement of multiple biomarkers from a small volume of sample.

In the present study, we describe the development and validation of a microsphere-based immunoassay for the simultaneous quantitation of five pituitary hormones (follicle-stimulating hormone [FSH], luteinizing hormone [LH], growth hormone [GH], thyroid-stimulating hormone [TSH], and prolactin [PRL]) from dried whole blood spot samples based on the modification and optimization of a commercially available kit. We compared pituitary hormone concentrations in 80 matched blood spot and serum samples and assessed assay performance using the following measures: blood spot-serum correlation, sensitivity/detection limit, and assay variability. We report highly significant correlations between matched blood spot and serum samples for all five analytes, and provide equations for converting blood spot concentrations to serum/plasma equivalents. Our results demonstrate the feasibility of simultaneously measuring multiple pituitary hormone concentrations from a single blood spot sample.

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Origin of hominid bipedalism: the energetics of chimpanzee locomotion

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One popular hypothesis for the origin of hominid bipedalism posits an energy savings associated with bipedal locomotion. Despite the attractiveness of this hypothesis, a paucity of data exists with which it may be tested. In 1973, Taylor and Rowntree conducted the only study to date of the energy costs of locomotion in chimpanzees. They found no significant difference in energy costs between bipedal and quadrupedal locomotion at any speed. The reliability of these results, however, has come into question because the Taylor and Rowntree (1973) sample comprised only two male chimpanzees, each two years of age. Moreover, debate exists regarding the interpretation of these results.

I examined the energy costs of locomotion in a sample of five chimpanzees of both sexes, ranging from six to thirty-three years of age, which were trained to perform on a treadmill. Oxygen consumption was measured during bipedal and quadrupedal locomotion at normal walking and running speeds. Adult chimpanzees are notoriously difficult to control. As a result, no treadmill data for adults exist. I was able to overcome this obstacle by using animals trained for the entertainment industry. Using these professional animals has allowed data to be collected on adult chimpanzees for the first time. Preliminary data suggest little difference between energy costs of bipedal vs. quadrupedal locomotion, but may show some dependence upon speed. Possible confounding factors to energy measurements unique to chimpanzees will be discussed as well as implications for the evolution of bipedalism in hominids.

Variation in postcranial robusticity in the Albany County Almshouse.

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The analysis of postcranial robusticity is useful for determining relative activity levels in past populations. However, robusticity research on poorhouse populations is limited. Almshouse paupers represent the underprivileged segment of an industrial population, most of which engaged in heavy labor. Subject to severe mechanical stresses, these people are expected to exhibit some of the highest levels of robusticity in modern human populations.

Postcranial measurements were taken on 532 individuals from the Albany County Almshouse skeletal collection and compared for differences in age, sex, and bilateral asymmetry. A non-significant increase was observed in diaphyseal dimensions with age, indicating that external robusticity is largely determined by early adulthood. When corrected for body size, males and females have similar diaphyseal robusticity in the upper limb, suggesting similar mechanical demands. In the femur, higher pilastric and robusticity indices in males indicate greater mobility compared to females. In terms of bilateral asymmetry, both males and females have significantly greater right humeral diaphyseal dimensions than the left side, and males additionally have greater right forearm dimensions.

Compared to several other prehistoric and industrial samples, the almshouse skeletal sample possesses high diaphyseal dimensions in the humerus, but a relatively low level of asymmetry. In contrast, the lower limb shows low robusticity indices, similar to other industrial samples,

indicating low mobility compared to earlier types of subsistence strategy. This research shows that the almshouse sample was subject to major mechanical stresses on the upper limb, but relatively low physical demands on the lower limb, which is associated with known occupations for these individuals.

Information loss in the reduction of multi-state scores to presence/absence proportions using Carabelli's cusp.

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The causation of dental traits such as Carabelli's cusp is still not completely understood (Dahlberg 1971; Scott and Turner 1997) complicating comparative analysis. The Arizona State University dental anthropology system (ASUDAS) has standardized dental trait scoring and become a widely accepted method (Irish 2005). The Barbados collection, housed at Southern Illinois University, represents the human remains from a slave cemetery on the Newton sugarcane plantation dating from the 1680s to about 1820 (Corruccini *et al.* 1982). This collection offers a unique opportunity to examine genetic admixture through the analysis of dental traits. Accordingly, we utilized the ASUDAS to determine the level of expressivity of the Carabelli's cusp on the upper first molars of the Barbados collection. Using a score of five as a threshold for presence/absence of the Carabelli's trait as described by Scott and Turner (1997), the slave sample, at 25.5% presence, corresponded to the range that characterizes populations from West Africa, but also Western Europe. To better understand our own data, we compared our original sample to another random sample of loose, unidentified, but mostly Egyptian, Euro American and Native American teeth collected from the Smithsonian. Both samples were characterized by overlapping bimodal distributions indicating a more appropriate presence/absence scoring threshold of three. This new threshold better represents the expressivity of Carabelli's trait in the two samples and also better illustrates the differences between them. The study also explores difficulties in scoring the phenotypic expression of dental traits due to the various factors that may affect that expressivity.

Comparison of coordinate digitizers for cranial surfaces.

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Four commercial coordinate digitizers are evaluated for measuring external cranial vault surfaces in our study of papionine metric, morphological and molecular diversity (Norris et al. 2006, this meeting). Primary concerns are fidelity of surface geometry and ease of use, with cost a secondary consideration. The four instruments employed are: electromagnetic Ascension Bird with standard receiver and pencil stylus (SB); electromagnetic Ascension miniBird with two 8mm receivers (MB); Immersion Microscribe G2 mechanical arm (MS); and Polhemus FastSCAN laser stripe digitizer (FS).

Two tests were conducted. First, points (N=28 - 30) on the upper hemisphere of a hard plastic ball (nominal 55mm radius, 0.05mm asphericity) were digitized with each device. Radius (R), root mean square errors (RMS) and maximum radial deviation (MD) of data points from a spherical numerical model were computed (all measurements in mm). For SB, R = 54.7675, RMS = 0.4162, MD = 1.8111; for MB, R = 55.9208, RMS = 0.3274, MD = 0.7991; for MS, R = 56.6342, RMS = 0.1375, MD = 0.3442. Second, we digitized points (N>204) on the exocranial surface of an adult female *Macaca mulatta* calvarium with left and right porions and right infraorbitale establishing a spatial orientation plane. Radial deviations of data points were computed for a spherical model, an ellipsoid model and a tapered superquadric model. For example, using MB, superquadric model, RMS error = 0.8612 and maximum asymmetry = 1.2673; sagittal/transverse squareness = 0.1037, coronal squareness = 0.0643. With device precisions differing within acceptable limits, particular applications dictate equipment choices.

Support for this investigation was provided by the Australian Research Council, the Pennsylvania State University College of Health and Human Development, and the Department of Kinesiology's Davis Fund for the Encouragement of Innovative Research.

Intergenerational and kinship effects on household fertility: A test from the Orkney Islands, Scotland.

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Many times historical demographic studies are descriptive in their approaches to documenting the change in recent human populations, rather than testing hypotheses based on predictions from models. This study tests the effects of kinship structure on net household fertility over the period 1851 to 1901 in the northern Orkney Islands, Scotland. The data used are the decennial censuses for Orkney and consist of individual level records indicating household membership, relationship to head, age, sex, marital status, occupation, birthplace and amount of land held. For the six islands in the study area, a total of 34,559 individuals and 17,242 households are represented. Hierarchical linear models are used to test for intergenerational effects of kin on the number of children in the household, conditional on household occupation, amount of land held, immigrant status, and presence of servants in the household. Preliminary results for one of the islands indicate significant positive effects of post-reproductive females (grandmothers), but a significant negative effect of total number of kin. This indicates that, although some extended family types are beneficial with respect to household fertility, increased competition for resources within the household presents a limiting factor to household fertility. These results are compared to an analysis of the other five islands in the study area. Fertility and kinship structure are varies across the islands as a result of differences in local ecology and local resources.

Spatial structure of Japanese macaque habitats: GIS analysis of core areas and habitat expansion in mixed agro-forest landscapes.

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Japanese macaque habitats are spatially structured by agriculture and forestry. We carried out GIS analysis to (a) identify core areas distant from agriculture, and (b) model the spatial inertia of habitat expansion. First, the core area analysis extracted monkey habitats that were more than 1 km from agriculture using vegetation maps of the Ministry of Environment for two, contrasting regions, the Kii Peninsula in central Japan, and the Boso Peninsula near Tokyo. In both peninsulas, small farm communities distributed along rivers insert fields deep into monkey habitats. Core areas comprised 44% of monkey habitat in the larger Kii Peninsula, and only 10% in the much smaller Boso Peninsula. Contrasting histories of forestry lead to a core area containing over 70% conifer plantation in the Kii Peninsula, but a much smaller core area with over 60% broad-leaf forests in the Boso Peninsula, while little difference in forest vegetation between core and non-core areas in either peninsula. Second, a spatial expansion model applied to the Boso Peninsula tested whether monkey habitat expansion was better explained by a cost-distance variable accounting for land use or by distance alone. Statistical significance improved for a logistic model of habitat expansion using the cost-distance variable, compared to

one using only distance. Thus, land use seems to affect the speed of habitat expansion in the Boso Peninsula.

Sexual dimorphism in the pelvis of *Microcebus*

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Sexual dimorphism in pelvic morphology has been documented in many anthropoids, and is frequently interpreted as a result of obstetric selection on females. Few studies of pelvic sexual dimorphism have focused on strepsirrhines, which typically have relatively smaller infants than do anthropoids. However, as female primates of smaller body size typically give birth to relatively larger infants, it is possible that the pelves of the mouse lemur *Microcebus*, the smallest extant primate genus, will show some evidence of selection on obstetric adequacy (i.e. some degree of pelvic sexual dimorphism).

This study examined osseous pelvic variation within a sample of *Microcebus* from the American Museum of Natural History. These specimens were collected from a single locality, Amboasary Madagascar, and probably represent one population. Eight pelvic and three femoral variables were measured. Males (n=8) and females (n=12) were compared using independent sample t-tests on raw data, and Mann-Whitney tests on shape or ratio data (the geometric mean of five pelvic variables was used as the denominator). Females significantly exceeded males in absolute values of sacral width, pelvic height, pubic length, and in distances from the pubic symphysis to the ischial tuberosity and points on the sacrum. Measurements of the femur were not significantly greater in females, thereby suggesting that the pelvic differences are not simply reflecting overall size dimorphism. Significant shape differences included greater relative pubic length and sacral width in females than in males. These data suggest that selection for obstetric adequacy may be present in these extremely small-bodied strepsirrhines.

2D vs 3D – Comparison of different approaches to the quantitative description of cusp surface areas on cercopithecoid teeth.

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In paleoanthropology, descriptions of teeth are usually based on simple linear measurements such as mesio-distal or bucco-lingual diameter, cusp height and related indices. Important features of the occlusal surface such as 2D or 3D cusp surface area are often not considered even though these measurements might carry phylogenetic and functional signals.

In this paper, we compare different measurement methods for cusp surface areas of extant cercopithecine lower M2s. Measurements are made on digital photographs and on 3D models of the occlusal surface acquired by different 3D methods (CT / microCT and optical surface scanners). Both photographs of the occlusal surface and 2D projections of the 3D models are analyzed using ImageJ. 3D surface area measurements are made in Amira™ after isolating the four main cusps. We investigate the measurement error of the projected cusp surface areas due to differences in orientation. We compute 2D and 3D cusp area ratios, and compare 2D and 3D intra- and interspecific variability. Preliminary results indicate that differences in 2D and 3D cusp area ratios may help in future in species recognition among fossil cercopithecines. The ratio of the 2D and 3D cusp surface areas characterizes the amount of relief on the teeth and has mainly functional relevance.

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Sleeping tree choice in Bwindi chimpanzees.

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Unlike other anthropoid primates, great apes build sleeping nests. In Bwindi Impenetrable National Park, Uganda, chimpanzees build nests nightly. We investigated patterns of nest tree use by Bwindi chimpanzees, in order to understand ecological influences on nest tree selection.

Between 2000 and 2004, 3,414 chimpanzee nests were recorded. Chimpanzees at Bwindi were selective in their use of nest trees. Of 163 tree species found in Bwindi (Butynski, 1983), chimpanzees utilized 38 for nesting. Of these, four tree species (*Cassipourea sp., Chrysophyllum sp., Drypetes sp.* and *Teclea nobilis* accounted for 72.1% of all nest trees. Ninety-three per cent of all nests were constructed in food tree species, although not necessarily while the tree bore food items used by the chimpanzees. For instance, chimpanzees fed in *Ficus sp.* during 82.4% of all scan sampling periods between 2001 and 2004, but only 2% of all nests were made in *Ficus sp.*

Using tree abundance data, a Spearman rank correlation found no significant differences in relative tree species preference among any of the five years of the study. A series of pairwise Wilcoxon signed ranks tests found no significant differences in the relative tree species preferences across any two months (with data pooled across years).

These results indicate that nesting tree species preferences are stable both within and across years. Four tree species are favored for nesting. The analysis suggests that Bwindi chimpanzees' choice of nesting tree species is not dependent on tree species density or use of the tree for food.

Investigations of a thermally affected burial from a historic cemetery in central California.

P. Stanton, M. Keur. Statistical Research, Inc.

In Spring 2005, seventeen discrete burials were exhumed for relocation from a small historic cemetery in central California. Only two of these burials featured grave markers. The burial population comprised ten adult males, three adult females and four juveniles. The grave orientations, burial postures and associated funerary artifacts were largely consistent among the individuals, with the exception of one adult male.

Although interred in a similar manner as others in the cemetery, this individual exhibited evidence of burning, particularly on the cranial vault and right knee. A concentration of charcoal, burned human and faunal bones and personal effects was discovered on the lid toward the foot of the coffin. The human remains recovered from this concentration included many elements of the hands and feet, likely belonging to the individual in the coffin.

Historical documentation from the township describes a fatal structure fire. Preliminary observations of the skeletal elements are consistent with the individual involved in this event. Furthermore, comparison of the burn patterns with those observed in controlled experiments and case studies suggests that this individual was involved in a structure fire. The contents of the charcoal concentration suggest a post-fire recovery and clean-up. Through multiple lines of evidence including historical documentation, osteological investigations and assessment of recovered artifacts, the authors were afforded a rare opportunity to identify an individual from an unmarked historical grave.

The victimology of warfare and risk of death at Orendorf.

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Orendorf, a Middle Mississippian site (~AD 1150-1250) from the central Illinois valley, appears distinctive in that it is likely the earliest fortified site in the region and 9% of the skulls exhibit definitive perimortem scalping. Other skeletons demonstrate cranial blunt force trauma, projectile wounds and decapitation. There is no evidence of large-scale massacres and the burial context is more suggestive

of raiding-type warfare. Warfare at the nearby Norris Farms Oneota site (~AD 1300) is also classified as raiding-type and Milner, et al. (1991) suggest victims of war were handicapped by pre-existing conditions, such as tuberculosis. The purpose of this study is to evaluate whether demographic factors and/or antemortem diseases increased an individual's risk of dying by warring activities at Orendorf. Age and sex were assessed using standard osteological techniques and antemortem conditions were described and categorized (e.g. arthritis, infections, fractures, vertebral pathologies, lytic lesions) for all of the nearly 300 individuals in the sample. Victims of warfare were identified by the presence of scalping, cranial blunt trauma, dismemberment, or, in some cases, burial context. Victimology includes adults of both sexes but lacks subadults. While victims of warfare exhibited a number of pre-existing conditions, especially vertebral arthritis, few individuals were likely debilitated by their afflictions. In contrast, several individuals lacking traumatic injuries likely had significant physical disabilities due to tuberculosis, treponematosis, spinal pathologies and arthritis. More intricate mortality models are required to better examine the relationship between multiple factors (e.g. pre-existing pathological conditions, age, status) and risk of dying from warfare.

Orangutan evolutionary history based on an analysis of 7 loci.

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This paper presents a population genetic reanalysis of orangutans based on seven genes collected from both Sumatran and Bornean populations. These analyses provide insight into orangutan population history, based on inferences of genetic diversity, population size, population divergence times, genetic differentiation, and migration rates. These estimates allowed a comparison of diversity and population size between Sumatran and Bornean orangutans. Within orangutans, the Sumatran population is about twice as diverse as the Bornean population. Orangutans are more diverse than African apes. Sumatran and Bornean populations show significant genetic differentiation and their history does not differ significantly from an 'island model' (population splitting without geneflow). Two different methods support a divergence of Bornean and Sumatran orangutans at ~3.1-5.4 million years ago. This suggests that Pleistocene events, such as the cyclical exposure of the Sunda shelf and the Toba volcanic eruption, did not have a major impact on the divergence of Bornean and Sumatran orangutans. Pairwise mismatch analyses, however, suggest that Bornean orangutans have undergone a population expansion between 39 - 64 thousand years, and Sumatran orangutans may have experienced population contraction. Pleistocene events may have contributed to these aspects of orangutans. These conclusions are applied to the debate on orangutan taxonomy.

Daily energy expenditure in fossil hominins: the contribution from locomotor costs reevaluated.

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Previous studies of daily energy expenditure (DEE) in hominin fossils have estimated locomotor costs using a formula that was based on six mammalian species, all 18 kg or less in mass and none of which are primates. Such factors create a number of problems when applied to hominins, especially as it is well established that the energetic cost of human walking is lower than that of representative mammals, particularly for individuals with long lower limbs. The current study reevaluates the DEE of a variety of hominin species using more specific approaches to estimating locomotor costs. To estimate non-locomotor DEE for primates, I relied on published data on body mass, day range, and the percentage of time spent in various activities. I then used more up-to-date methods to calculate the daily cost due to locomotion and summed the two to calculate total DEE. This method results in lower estimates of energy expenditure for locomotion than in previous studies. Values obtained here for DEE in various representatives of *Australopithecus* are lower than reported previously, by around 200 kcal/day. Taking into account the greater economy of human walking, particularly that due to the longer limbs found in many *Homo*, also results in lowered estimates of DEE. Elongation of the limbs in *H. erectus* over that seen in AL 288-1 reduced *H. erectus* travel costs nearly 50%. The present method for calculating DEE further indicates that female *H. erectus* total DEE was 84% greater than that of female *Australopithecus*, even larger than that suggested by previous workers.

Tail posture during arboreal quadrupedalism in four species of leaf monkeys at the Endangered Primate Research Center, Cuc Phuong National Park, Vietnam.

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Vietnam contains a diversity of folivorous primate species, the locomotor kinematics of which are relatively unexplored. Recent work in Cuc Phoung National Park reveals marked differences in tail postures among four similarly sized leaf monkey species. Housed in seminaturalistic enclosures, subjects were filmed walking on horizontal supports approximately 2 inches in diameter. Cameras were positioned in lateral view, far enough from subjects to reduce effects of parallax. Frame rates were optimized to catch rapid movements, with shutter speeds set to reduce motion blur. Video clips were imported into Peak Motus and kinematic points along the back and tail digitized at forelimb and hindlimb touchdown, midsupport and lift off. Data were rank-transformed and analyzed using ANCOVAs with locomotor velocity as the covariate. During symmetrical walking, doucs (*Pygathrix nemaeus and P. cinerea*) typically allow the tail to hang down, falling along the substrate behind them during travel. Delacour's langurs (*Trachypithecus delacouri*) exhibit greater variability, often arching the tail higher in concave-downwards posture. Hatinh langurs (*Trachypithecus laotum hatinhensis*) exhibit the greatest variability in tail posture, often raising the tail in a concave-upwards arc with the tip reaching over the thorax. These patterns may reflect adaptations to different substrate types in the wild. Whereas doucs are entirely arboreal, wild Delacours and Hatinh langurs include steep limestone karst formations to varying extents in their substrate repertoires. Further exploration of postural and locomotor adaptations in these taxa is pivotal to their conservation and captive management.

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Attention–Deficit Hyperactivity Disorder (AD/HD) and fluctuating asymmetry (FA) in another college sample: male/female difference.

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Attention deficit/hyperactivity disorder (AD/HD) represents a developmental lag that may be reflected in fluctuating asymmetry (FA), differences from perfect symmetry in traits that display bilateral symmetry. Burton et al. (2003) found a statistical trend for FA to increase (Dermatoglyphic Index or as a Total Index) as

the behavioral measure for AD/HDness (Rasch logit values derived from Wender Utah Rating Scale [WURS]) increases in males but not in females. The objective here is to do a similar study in an independently collected sample of college students (n = 222, 61m, 161f) not selected for AD/HD looking at FA vs. symptoms for AD/HD listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM IV) and the more comparable shortened WURS (both as summed Likert [L] and Rasch versions [R]. FAs were lowest for hand and foot, intermediate for ridge counts and highest for face and ranged from 0.01 ± 0.001 in foot traits to 0.6 ± 0.005 in face width for both sexes; they are consistently the same or higher in males relative to females for all traits except for digit 5 length. Males display higher AD/HD symptom rates overall. After Bonferroni correction the only significant FA correlation with a behavioral measure is between the foot index and the R-WURS in females ($p = 0.002$, $r^2 = 0.034$). Female feet are sexually selected for small size which may lead to increased vulnerability to developmental stress in some individuals.

Intracemetery biological patterning at Windover Pond.

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Analysis of phenotypic variation in relationship to spatial structure is presented for burials at Windover Pond, an Early Archaic period mortuary site located near the Atlantic coast of Florida. Previous analysis of burial stakes that were recovered *in situ* suggested their use as markers of discrete burial areas within the pond, hypothesized to represent maintenance of family or kin-specific burial areas. Woven fabrics associated with burials differed spatially in their manufacturing technique and size of raw material components, suggesting the presence of distinct weaving groups (possibly matrilines) within the cemetery.

Data were collected for several hundred craniometric, odontometric, cranial nonmetric, dental morphological, dental anomaly, and malocclusion variables and analyzed in reference to micro (kin burials) and macrostructure (larger social units) within the pond. Pattern recognition, join count analysis, and Mantel tests were used to test for spatial structure to the biological data.

Results suggested a basic east and west division of burials within Pond C. West division burials demonstrated crown complexity, while east division burials had simpler dental morphologies and excessive malocclusion. Spatial-genetic distances were significantly correlated for females only, suggesting a matrifocal burial pattern. We propose Pond C at Windover was used by two bands that congregated seasonally. Annual variation in water level precluded direct tracking and placement of kin, and segments were demarcated by burials stakes. That morphological data patterned perpendicular to the pond margin suggests low mortality in relationship to the range of water level fluctuations through time.

An elusive paleodemography? Age distributions of death at Copan.

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For paleodemography, the age distribution of deaths of a skeletal population has potentially useful demographic information about past populations. However, it has also been obvious to researchers that one of the most important problems that must be solved to allow valid investigation of the past is determining with some accuracy this age distributions of deaths. However, present methods tend to overage and then underage older individuals. The result is that most paleodemography has been criticized for having populations that are probably aged too young, with too low proportion of individuals over 50 years of age at death. While various suggestions have been made about dealing with this problem, one that is gaining popularity is to use Bayesian methods comparing age-related morphological stages of an indicator from a reference population to those of a skeletal sample.

The goal here is to investigate exactly what age distribution of deaths result when various techniques are applied to the auricular surfaces of the adults of a skeletal population, in this case, from the Precolumbian Maya of Copan, Honduras. The seriation method suggested by Lovejoy and associates in 1985 is compared with the Bayesian estimations recently suggested by Buckberry and Chamberlain in 2002. The differences are instructive. The Bayesian estimation results in a population that is too old to be a realistic age distribution of deaths, while the seriation method has the drawbacks of not enough old adults and no statistical rigor. Determining an accurate age distribution of deaths continues to be elusive.

Fluctuating asymmetry in the human cranium: differential diagnoses of taphonomical, pathological and 'normal' population asymmetry.

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Fluctuating asymmetry has been demonstrated to be a useful tool for osteological analysis as it detects disruptions in the developmental stability of osseous structures attributed to pathological processes, genetic predisposition, congenital abnormalities, environmental influences, or biomechanical stresses. As measurements of fluctuating asymmetry are usually small, great care must be taken during data collection. Any observer error in measurement or an inability to distinguish taphonomical processes from biological asymmetry could either disguise or create false interpretations of the results. Similarly, it is important to distinguish between asymmetry that is normal population variation from that which is the result of individual developmental instability. The current study assesses the presence of fluctuating asymmetry in the human cranium and sets criteria for the differential diagnosis of taphonomic deformation, pathological and 'normal' population asymmetry through the creation of a database of twenty-two bilateral measurements from over 600 crania from seven English skeletal populations. The results indicate at least a quarter of the crania available for study had to be disregarded due to taphonomic deformation and that a high degree of fluctuating asymmetry is the population norm. However, many individual asymmetry scores exceeded this population norm and could be attributed pathological conditions such as muscular torticollis, paralysis and premature cranial synostosis. It is the conclusion of this study that fluctuating asymmetry is an efficient way to highlight "deviants" from the population and that in many cases cranial asymmetry has previously been both under- and over-diagnosed in past populations.

Age estimation and paleohistopathology of a late pre-Hispanic elite: demography and health among the Sicán leadership, Lambayeque Valley, Peru.

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From AD 900-1350, the Sicán state (also called the Lambayeque Culture) flourished on the north coast of Peru. Bioarchaeological studies of two elaborate high-status tombs under the Huaca Loro pyramid demonstrate significant demographic and health status differences among the male principle personages and occupants (Shimada et al., 2004). Building on this initial characterization of elite demography and health, we employ a histological approach to assess age and health profiles of a lower-echelon elite

from Illimo, Peru. Poor preservation confounded most data collection, but visual inspection of skeletal and dental fragments suggest the Illimo principle personage was a skeletally healthy male over the age of 35.

A cross-section from the midshaft of the left clavicle was examined under light microscopy. As osteon and osteon fragments were hard to distinguish, our results are conservative. Using the Stout and Paine (1992) formula, we estimate an age of 41.96 years; using the Stout et al. (1996) formula, age-at-death is calculated at 48.1 years. Osteon size suggests the individual was not over 50. Resorptive bays on periosteal surfaces appear abnormal and may represent initial stages of a lytic pathological condition.

Age-at-death of the Illimo principle personage is consistent with the other tombs, suggesting life expectancy of Sicán (or Classic Lambayeque) elite males averaged approximately 45 years. While the Huaca Loro personages did not manifest chronic skeletal infection, the Illimo data may suggest lower-level elites were perhaps not equally buffered from infectious disease, highlighting the socially constructed relationships between health and social status in this culture.

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Craniofacial strain patterns during premolar loading: implications for australopith feeding.

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Relative to other hominids, "robust" australopiths exhibit massive "molarized" premolars, and it has been suggested that at least some of the derived facial features seen in these species are adaptations designed to resist elevated premolar loads. The premise of this hypothesis is that the stresses in the face induced by premolar loading differ from those induced by molar loading. This premise is tested using finite element analysis.

A finite element model of a *Macaca fascicularis* skull was constructed, assigned the elastic properties of craniofacial bone, subjected to forces corresponding to the muscles of mastication, and constrained at the temporomandibular joints and the bite point. Previous validation studies have shown that the model deforms in a broadly realistic fashion. Five modeling experiments were performed in which the position and extent of the bite point along the cheek teeth varied. Results indicate that postcanine bite point position has a substantial influence on craniofacial strains, which are highest when the premolars are loaded in isolation. Results are consistent with hypotheses stating that some derived craniofacial features in "robust" australopiths may be adaptations to withstanding premolar loads. Although a diet of small, hard objects cannot be ruled out, our data are consistent with a hypothesis that these craniofacial features evolved in "robust" australopiths for premolar use in the initial stages of preparing large, resistant food items for ingestion.

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Age estimation method for the subadult rib cortex.

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Cortical bone retains a record of the systematic changes associated with growth and development. Studies on adult cortices have yielded information on metabolic processes such as bone formation and remodeling rates, that have been used to assess the health status of past and modern populations and to develop histomorphometric age-at-death estimation methods. While many studies have focused on the adult rib cortex to ascertain information on age, nutritional and health status, and the quality of bone, few studies have included subadults. Until now no studies have focused solely on the rib cortex of subadults. As a result, there is a paucity of information on histological variables useful for describing the nature and timing of the normal processes that determine rib morphology of the growing skeleton. As a result, there is no histological aging method for use in subadults. This analysis of the systematic changes in the microstructure of the rib cortex of 72 autopsied, nonpathological subadults (2 to 21 years old with a mean age of 14.2±5.2 years), establishes a baseline of parameters that permit a more thorough investigation of juvenile growth, health, and activity patterns. This research also provides a method of age-at-death estimation that can be applied to subadults in forensic, archaeological, and paleontological contexts.

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Phayre's leaf monkeys (*Trachypithecus phayrei*) as seed predators in the Phu Khieo Wildlife Sanctuary, Thailand.

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Despite their name, Asian leaf monkeys are known to consume a variety of food items in addition to leaves. While young and mature leaves form an important part of leaf monkey diets, fruit and seeds are also important when available. The consumption and consequent destruction of seeds may be an important factor in habitat dynamics where leaf monkeys are common. I investigated annual variation in the consumption of immature seeds by Phayre's leaf monkeys as part of a long-term study of their behavioral ecology and sociobiology. Five 20-minute focal samples were conducted each month for all adult monkeys in three social groups (N=23), with instantaneous sampling of behavior at one-minute intervals. Food category, age, and part were described for all feeding behaviors, and plant samples were collected for identification and nutritional analysis. Feeding time is calculated as a percentage of total instantaneous samples for each category. Samples pooled across a twelve-month period indicate that the consumption of young seeds (22% of the diet) was second only to the consumption of young leaves (28%). Mature leaves and fruits made up an additional 30%. Furthermore, young-seed consumption was substantial in nine of twelve months, with its contribution to the diet varying across the year, occupying as much as 50% of the monthly diet. Phayre's leaf monkeys consumed seeds from the family Leguminosae most often. Preliminary analysis suggests that immature seeds are good sources of dietary fat.

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The utility of carpal bones for sex determination.

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Sex determination is a key issue when investigating human remains either from crime scenes or archaeological sites. Sex is usually determined by examination of the skull and pelvis however this may not always be possible if a skeleton is fragmented or incomplete. The present study investigated the potential for using carpal bones to determine sex, utilizing one hundred individuals of known-sex from the Christ Church, Spitalfields Collection, housed at the Natural History Museum in London. A series of newly-defined measurements were applied to different carpal bones. Paired t-tests to investigate side asymmetry of the carpals revealed that some, but not all, measurements were

consistently larger on the right hand side than the left. Inter- and intra- observer error tests showed that all measurements were satisfactorily reproduced by the first author and another observer.

Independent t-tests confirmed that all carpals were sexually dimorphic in various degrees. Using SPSS program (version 12.0), discriminant function analysis of osteometric data from the carpals provided reliable methods for determining sex from single and multiple carpal bones. Stepwise discriminant function accuracies ranged from 71.1 to 88.6%, direct ranged from 74 to 100% and univariate measurements from 64.6 to 84.7%. All functions derived were tested for accuracy on a sample of twenty additional individuals from the Christ Church, Spitalfields Collection.

Digesta passage time in Southern Muriquis (*Brachyteles arachnoides*, Atelidae, PRIMATES)

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Several primate species lack information on their food choice nature and how those are related with their digestive physiology. This includes whether food choices are based upon physical or chemical factors and its interface with digestive efficiency. The importance of evaluating primate gastrointestinal adaptations in understanding primate ecology and behaviour has also been recognized. *Brachyteles* have notable adaptations of the digestive tract (e.g. dentition traits and large cecous) compatible with both folivory and frugivory. Although muriquis preferentially rely on fruits, they are able to support a diet that almost comprises entirely of leaves during fruit scarcity. Muriquis also present suspensory locomotion and digesta passage times that are more compatible with frugivory. This study presents digesta passage times for southern muriquis inhabiting a semi-captive environment with some natural vegetation. Six animals were individually monitored from one to four complete digestion trials (144 hours each trial). Subjects were fed food loaded with small plastic markers. Continuous day and night observations registered all defecation episodes times of subjects. Digestive measures estimated from these observations included transit time, time of last appearance and mean retention time. Sex, age, and body weight did not affect digestive strategies. However, muriqui females (including one lactating female) retained food for longer periods than males. It is suggested that this may be an effect of metabolic requirements maximizing digestive processes of nutrients extraction and absorption. These results are discussed in context to body size, efficiency of gastro intestinal tract and dietary types.

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Native-American-DNA.com: genetics and race online.

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Roughly 15 companies market DNA tests for "Native American markers" on the Y chromosome, mtDNA, and in autosomal DNA, with new companies coming on-line each year. At least two companies market DNA fingerprint tests to tribes. I focus on the scientific-cultural claims of five companies that target the Native American identity market; i.e. genealogists, recognized tribes, would-be tribal members, and nonprofit organizations concerned with legitimating Native American identity. Specifically, I look at the practices of DNAPrint Genomics, DNAToday, Genelex, GeneTree, and Orchid Cellmark.

I examine how each company targets one of two overlapping categories, "race" or "tribe", as scientific objects when they are primarily political, cultural, social and historical categories. I highlight company claims—both textual and in creative imagery—that tie Native American racial/tribal identity to DNA markers. I also look at how several companies target the political arena of tribal enrollment and rights, either by marketing in Native American theme venues or directly to tribes. Some directly claim that ancestry DNA might be used to access "Native American benefits", and others steer clear of such claims. However, others also use imagery that locates Native American identity closely to the DNA double helix. While not all companies that provide "Native American DNA" testing use problematic marketing claims and imagery, the extent to which a company's imagery and claims are politically charged tends to rise with the extent to which it targets Native American-related forums.

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Culture change and helminthiasis among the Tsimane' of lowland Bolivia.

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The goal of this study was to investigate how acculturation and economic integration influence the distribution of soil-transmitted helminths among the Tsimane' Amerindians of lowland Bolivia. Although several researchers have examined the effects of culture change on intestinal parasitism, results have been mixed. In a one year panel study, fecal samples and lifestyle interviews were collected for 119 adults (64 females and 55 males) ranging in age from 17 to 69 years. Microscopic examinations revealed high levels of helminth infections with 86% harboring one or more species of helminth. The most common infection was hookworm (*Ancylostoma duodenale* or *Necator americanus*) with 82% of adults infected. *Ascaris lumbricoides*, *Trichuris trichiura*, and *Strongyloides stercoralis* were also identified at lower frequencies. A repeated measures linear regression model was used to examine how variation in behavioral factors, education levels, and economic resources was associated with the distribution of the soil-transmitted helminths. Formal education was most strongly associated with reduced levels of soil-transmitted helminth infection. Age, sex, and household access to potable water also were significantly associated with parasite levels. Variation in individual material wealth and cash income was not associated with the distribution of helminths throughout the study communities. This study suggests that for Tsimane' adults the occurrence of parasitic disease is more closely related to education and individual behaviors than economic resources.

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Variation in brain size and ecology in *Pongo*.

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In primates and other mammals, increases in brain size, independent of body size, generally reflect cognitive specializations or increased intelligence. Brain size is also correlated with important life history variables. The strength of this relationship varies considerably among taxa, and the nature of the underlying processes is still widely discussed. Studies at the lowest macro-evolutionary levels may help identify relevant social or ecological factors that affect the correlation between brain size and life history.

Here we explore brain size variation in orangutans. We measured cranial capacity (CC) and skull dimensions on a maxi-

mum sample of 250 adult orangutans comprising four geographic populations (*Pongo spp*). Palate length and a GM of selected skull measurements were used to control for skull size differences amongst populations. Factorial ANOVA was used to test for significant sex, population, and interaction effects on CC. To evaluate size-adjusted differences in CC, we employed the method of residuals derived from regressions of CC on palate length and the GM.

There are significant ($p<0.05$) sex and population differences in CC, but no interaction effect. When adjusted for skull size, average CC is significantly smaller in *Pongo pygmaeus morio* compared to *P.p. pygmaeus* and *P. abelii* for both sexes. Amongst orangutan populations studied, *P.p. morio* has the shortest interbirth interval, supporting the existence of the life-history link at the lowest taxonomic level. They also face the longest and most unpredictable lean periods, suggesting this is one context in which brain size reduction may have been favored.

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Skeletal dimorphism in *Australopithecus afarensis*: a reply to Reno et al. (2003).

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In a recent publication, Reno et al. (2003) deviate from the general consensus and suggest that *Australopithecus afarensis* had a human-like pattern of skeletal dimorphism. To increase the fossil sample size, they use "Lucy" (AL 288-1) as a template, and estimate other specimen's dimensions from the straight ratio formed by her frame. This assumption of isometry in *A. afarensis* is likely to be erroneous. In this paper I address this by using Lucy as an "allometric" template rather than as an "isometric" template. Her frame determines the appropriate RMA (reduced major axis) regression equation (human or African ape) that is used to predict the femoral head measures of the other fossils.

I use the same analyses Reno et al. (2003) employ to estimate sexual dimorphism in skeletal elements: CV (coefficient of variation), BDI (Binomial Dimorphism Index), and MMR (maximum/minimum ratio). As in Reno et al. (2003), CV and MMR are checked for sampling error with bootstrap analysis. The findings suggest that the degree of sexual dimorphism in the femoral heads of the *A. afarensis* sample is greater than that of the human or chimpanzee samples, and very close to but below that of the gorilla sample. This degree of skeletal dimorphism implies that monogamy was not likely the principle mating structure of these hominids, as Reno et al. (2003) argue.

Heterosis and heterochrony in hybrid macaques.

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Hybridization has received attention in the primate literature, with respect to its effects on non-metric traits. Heterosis (hybrid vigor) is achieved when the hybrid phenotype exceeds the midpoint of the parental taxa. Thus, hybrids exhibiting heterosis typically have larger body size and increased size in other phenotypic characteristics than the average of the two parental species (Schillaci et al., 2005).

The goal of this study is to evaluate the effects of hybridization/heterosis on growth, particularly heterochrony and growth allometry. Least squares regression was used to assess hybrid growth trajectories relative to non-hybrids for males and females of hybrid and parental subspecies of *Macaca mulatta* using age, crown-rump length (CRL) and weight data from Smith & Scott (1989).

In both male and female rhesus macaques, the regression lines for weight to age and CRL to age are similar. All hybrids achieve a larger adult size, consistent with heterosis. The regression lines indicate a pattern consistent with predisplacement in males and acceleration in females, resulting in a slight adult paedomorphosis in hybrids. However, slope and intercept estimates for hybrids and non-hybrids fall within 95% confidence intervals of each other indicating associated growth trajectories. Therefore, a paedomorphic descendant shape cannot be supported and larger adult size is a result of hypermorphosis. There is little or no variation in the relationship between CRL and weight in hybrids vs. non-hybrids, indicating closely associated allometric trajectories.

Although hybridization results in heterosis, it does not appear to significantly affect growth allometry or heterochronic processes in this sample.

The influence of feeding behavior on reproduction in *Eulemur rubriventer* in SE Madagascar.

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Research suggests synchronized breeding within lemur species allows weaning to occur during the time when food is most likely to be abundant. Six groups of *E. rubriventer* were studied in Ranomafana, Madagascar to determine whether feeding behavior had an effect on reproductive output. Two groups were observed in Vatoharana, a pristine rain forest site, and four groups were observed in Talatakely, a disturbed site. All six females delivered infants. Two females (TRI, GS) delivered infants outside the typical birth season, which survived less than 2.5 months. This study investigated whether adult females differed in the relative amount of time spent feeding, and preferred resources.

There was no difference in the percent of time spent feeding in any of the females. However, TRI did have a lower mean feeding time (8.4%). Females in Vatoharanana exploited a greater diversity of species (range 29-30) than females in Talatakely (range 10-19). Each female focused on a single plant species 17% of the time or more. Two females overlapped in their preferred species, feeding most often on guava, an invasive species only present in Talatakely. Of the four Talatakely females, only these two individuals had successful births.

While feeding rates may not be a good measure of reproductive ability in *E. rubriventer,* nutritional content and distribution of resources may play a role. As *E. rubriventer* ranges are somewhat restricted by sympatric species, and guava is a patchy resource at this site, females lacking guava in their home ranges may not have access to this resource.

Bioarchaeological evidence for nutritional variation among prehistoric Jomon foragers.

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Recent data indicate complex subsistence networks among prehistoric Japanese foragers. Greater dietary reliance on marine resources is recorded among the eastern Jomon, while plant dependence prevailed in western and inland Japan. Given the preponderance of evidence linking plant dependent diets to wide-spread nutritional stress, this study tests the hypothesis that regional variation in Jomon dietary patterns led to differing rates of nutritional stress. The hypothesis that the marine based foraging patterns of the eastern Jomon led to lower nutritional stress rates than those observed among samples from western/inland Japan is also tested.

The presence/absence of porotic hyperostosis (n=477 crania), carious lesions (n=3456 teeth), and enamel hypoplasia (n=674 teeth) was recorded from skeletal remains recovered from five archaeological sites: Yosekura and Kitamura from inland/western Japan and Yoshigo, Inariyama, and Nakazuma from eastern Japan. Isotopic data are available for Yoshigo, Kitamura, and Yosekura; zooarchaeological remains evidence subsistence choices at Inariyama and Nakazuma. All sites date between 4000 and 2300 yBP. Lesion frequencies were compared using a G-statistic.

Porotic hyperostosis was significantly less prevalent among eastern foragers (4.8%) than western gatherers (15.2%). Similar differences were observed in enamel hypoplasia frequencies: eastern foragers (39.1%), western gatherers (50.5%). Carious lesion disparities between eastern (5.5%) and western (5.5%) Jomon were absent. The overall trend in lesion frequencies, however, demonstrates significant variation in nutritional stress patterns among eastern and western/inland Jomon. These differences support the hypothesis that dietary heterogeneity led to differing rates of nutritional stress among the Jomon, with fewer lesions observed among eastern marine foragers.

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Variation and diversity in *Homo erectus:* A 3D geometric morphometric analysis of the temporal bone

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The taxonomic composition of *H. erectus* (sensu lato) has been widely discussed in the scientific literature and increasing numbers of researchers are utilizing metric variables in their analyses of this species. However, these studies have seldom moved beyond basic indices or linear measurements, and consequently there is a lack of consensus regarding the partitioning of variation within this taxon.

To test the hypothesis that variation within *H. erectus* (s.l.) is consistent with that of a single species, eighteen 3D landmarks of the temporal bone were digitized on 520 fossil and extant hominid crania. Landmarks were registered by generalized Procrustes analysis, and Procrustes distances calculated for comparisons of individuals within and between the extant taxa. Distances between fossil specimens and *a priori* groupings of fossils were then compared to the distances calculated within the extant taxa to assess variation within the *H. erectus* sample relative to that of known species and subspecies.

Results of these analyses indicate that shape variation within the entire *H. erectus* sample is higher than extant hominid intra-specific variation. Shape distances within geographical groups of *H. erectus* are also high, and OH 9 and Dmanisi 2280 are morphologically distinct from the Koobi Fora specimens, which some workers assign to *H. ergaster*. These findings suggest that, although *H. erectus* may be composed of multiple species, the differentiation is complex, and specimens cannot easily be grouped geographically or temporally. Therefore, the division of H. erectus (s.l.) into early African/European and later Asian species is not supported by these results.

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The National Missing Persons DNA Database (NMPDD): A resource for the identification of unidentified human remains.

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The Federal Bureau of Investigation's (FBI) National Missing Person DNA Database (NMPDD) program assists in identifying missing and unidentified persons using the National DNA Index System (NDIS) of the FBI's Combined DNA Index System (CODIS). Samples for the NMPDD are typed for mitochondrial DNA and nuclear DNA. DNA profiles from unidentified human remains are compared to DNA profiles from missing persons and biological relatives of missing persons. Samples that are not matched are uploaded into the NDIS of the CODIS. Samples are submitted to the NMPDD from Local, State and Federal Agencies. Most of the unidentified human remains are received as osteological specimens. This presentation outlines the history and successes of the NMPDD, describes the processing of submitted samples for DNA profiling, and provides information to the anthropological community on how to submit unidentified skeletal remains through local, state and federal law enforcement agencies for inclusion in the NMPDD.

Measurement of testosterone from infant fecal samples.

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The relationship between salivary testosterone and a variety of physiological, behavioral and biosocial variables in children has been the focus of much recent research. Salivary testosterone studies, however, are complicated by difficulties in collection, gender differences in reliability, and questions about the power of salivary measures to detect behavioral associations. These problems are further exacerbated in young infants where, prior to teething, the provocation and collection of sufficient saliva to assay is uncertain and requires the use of cotton swabs, known to interfere with quantifiable levels of testosterone. Given these methodological difficulties, the present study aim was to further expand the scope of our non-invasive investigations of hormonal activity in infancy by developing and validating a method for assessing fecal testosterone levels.

Fecal samples (N=500) from a subset of 10 infants enrolled in a longitudinal study were collected in diaper liners. Samples were excised, weighed, and subjected to methanol extraction, modified from that previously developed for non-human primates. Extracts were assayed using a modified DSL testosterone RIA kit. Method validity was supported by a recovery rate greater than 90%, a sensitivity of 0.01 pg/ml, and inter- and intra-assay coefficients of variations less than 10%. Testosterone was detected in both male and female samples, with discernible sex differences in hormonal levels. Samples also provided evidence for significant inter- and intra-individual variation.

Fecal measurement of testosterone is a powerful non-invasive tool for exploring both the development and function of testosterone in human infancy and the relationship between testosterone and salient biobehavioral variables.

Neolithic human remains from Dakhleh Oasis, Egypt: an analysis of the dentition.

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Paleoenvironmental evidence suggests that a humid phase took place in the eastern Sahara from the early to mid-Holocene (c. 9500 to 6100 B.P.), followed by a period of aridification. This climate change would have had a great impact on available dietary resources. Most archeological sites in the Dakhleh Oasis dating to the mid-Holocene are located near the center of the oasis and it is likely that the local Neolithic pastoralist populations were under considerable dietary stress. This paper uses dental and gnathic evidence from Neolithic sites in Dakhleh to determine if human populations show evidence that may be related to climatic deterioration. Seven individuals, recovered from several localities, exhibit a number of dental pathologies. These include enamel hypoplasia and hypocalcification, dental caries, periodontal disease, and dental abscesses. These data indicate that the population, as represented by these individuals, was likely subject to long periods of health stress during childhood and throughout their lifetime. What caused the health stress is unknown, but diet, malarial infection, and/or parasitic

infestations are possible candidates and this may reflect worsening environmental conditions. These burials therefore provide new information about the Neolithic peoples of Dakhleh Oasis and expand knowledge of the desert populations during the mid-Holocene of Egypt.

The effects of body proportions on thermoregulation: an experimental approach.

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Numerous studies have discussed the influence of thermoregulation on hominin body shape concluding, in accordance with Allen's rule, that the appearance of relatively short limbs on both extant as well as extinct hominin populations offer an advantage for survival in glacial climates by reducing the limb's surface area to volume ratio. Conversely, longer limbs are thought to be advantageous in dissipating heat.

If longer limbs result in greater heat dissipation, we should see higher resting metabolic rates (RMR) in longer limbed individuals when ambient temperatures are significantly below 98.6, since the resting rate will need to replace the lost heat. The reverse should be true of shorter limbed individuals. We collected resting oxygen consumption on volunteer human subjects to assess the correlation between RMR and lower limb length in human subjects.

Total leg length exhibits a statistically significant relationship with resting metabolic rate ($p<0.001$; R-square = 0.794). This strongly supports the hypothesis that as leg length increases, resting metabolic rate increases as predicted. It appears that this relationship is driven primarily by femoral length, rather than tibial length.

The results of the present study confirm the widely held expectation of Allen's rule, that short limbs reduce the metabolic cost of maintaining body temperature, while long limbs result in greater heat dissipation. The present results do not reveal any thermal advantage in lengthening the tibia segment. The shorter limbs of Neandertals, despite being energetically disadvantageous while walking, would indeed have been advantageous for thermoregulation.

Who was buried in the Old Frankfort Cemetery? Using ancient DNA to leverage anthropometrics.

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Once lost to history, the Old Frankfort Cemetery was discovered in March 2002. Archival research simply indicates that the cemetery was in use between 1800-1860, and inferences concerning the demographics of the cemetery must be made from excavated materials and remains. Who was buried in the Old Frankfort Cemetery? While the Commonwealth may have used this cemetery to bury inmates of nearby First State Penitentiary, it was likely used as a community cemetery by poor and lower middle class families. Analysis of an early cemetery used by regular folk can provide insight into the demographic dynamics of early to mid-nineteenth century Kentucky. Anthropometric data suggest contributions from Native American, African, and western Eurasian populations, but rigors of manual labor within a largely agricultural economy left their mark, and many population assignations are tentative. DNA analyses were undertaken to clarify population affinity of maternal lineages.

Mitochondrial sequence was amplified using DNA isolated from intact teeth in order to assign population affinity. Multiple clones of each replicate were sequenced to ensure stability of phylogenetic signal. After successful extraction, amplification, and cloning of 40 samples at 5x coverage for HV1, preliminary sequencing of 10 individuals at 3x coverage document the presence of both African and European mitochondrial lineages in the cemetery. These results support the anthropometric data suggesting that the cemetery was demographically diverse.

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Three-dimensional digital quantification of joint surface area and its contribution to osteological research.

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In osteology, surface area is easily observed but because its quantification is difficult to capture by traditional approaches, it is rarely included in research. As a result, variation in the surface area of human skeletal features has never been thoroughly investigated. A study that examined how joint surface area could contribute to the determination of sex, stature, and age at death was conducted with the area of various joints captured through 3D laser-assisted stereo modeling.

An optical laser scanner, accurate to 300 µm, was used to create digital replicas of the femoral and humeral head, auricular surface, and scapular glenoid cavity of each skeleton from the sample. A mathematically rule-based algorithm, written at ASU's Partnership for Research in Spatial Modeling laboratory, was used to segment the surface of each feature. Area was quantified by summation of voxels in the segment.

Surface area was found to be similar in the degree of sexual dimorphism and utility in predicting stature compared to traditionally-used variables. Age-related morphological changes of the auricular surface did not manifest in measurement of surface area. Although more labor intensive than traditional methods of measuring surface area, 3D digital quantification is most accurate, most objective, and most replicable and in this study has shown to be an innovative approach to studying skeletal sex, stature, and age at death. In addition, the methods used here can serve as a springboard for other studies to incorporate digital modeling into their research designs, such as those on musculoskeletal stress markers or allometry.

Quadric-based metrics for shape analysis of three-dimensional osteological surfaces.

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A quadric-based method for analyzing 3D osteological surfaces is presented. Many bone and joint surfaces often lack easily discernable anatomically homologous landmarks raising problematic issues for comparisons using established morphometric methods that rely on landmark coordinates. The presented strategy involves fitting modeled quadric surfaces to unordered sets of points and subsequent comparisons are performed on the modeled surfaces, rather than the measured surfaces. A quadratic representation of the surface is motivated by the typical description of many osteological surfaces as having either one or two "curvatures", but this method may be extended to higher degree polynomials as well. The coefficients of a quadratic equation form a concise description of the salient qualities of shape and simultaneously establish a geometric correspondence between sur-

faces. Analyses of the coefficients highlight important shape qualities that morphologists are often interested in quantifying. Using polar coordinates, these data are visualized in a manner that is simple and intuitive to interpret within a shape context. This approach reduces errors accumulated from 3D acquisition devises along with non-meaningful variation in actual surface data; however, the true shape information contained within the raw data is also reduced. Therefore, this approach should not be used if such data loss is not appropriate for the research question under study. However, the proposed approach has an important advantage over discrete techniques in that it does not require a consistent number of sampled points on each specimen; therefore, comparisons of 3D data sets that differ in point density and distribution can be performed.

Polymorphism, character fixation, and soft homoplasy: Interpretations of intraspecific variability in omomyoid phylogeny.

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Investigations of relationships within the primate superfamily Omomyoidea demonstrate the presence of high levels of homoplasy. The independent fixation of character states may be considered evidence of the dentitions and skeletons of early primates. However, recent investigations of intraspecific variability among omomyoid primates demonstrate that character fixation is relatively uncommon, and that single primate taxa can be quite variable, particularly in dental characters.

This research evaluates the influence of intraspecific variability on interpretations of character evolution within the Omomyoidea. Using PAUP*4.0 and 100 dental and postcranial characters, a series of five cladistic analyses is performed on seventeen omomyoid species. For each analysis, the number of specimens examined for each element is increased (n=1, n=2, n=5, n=10, n=20) thus expanding the incidence of polymorphic characters for each species. Following the frequency bins method of Wiens (1995), polymorphic characters are scored on a scale denoting the percentage to which each state is present. Trees are then examined for topographical and statistical variance using MacClade 4.07.

Results indicate that whereas the number of most parsimonious trees decreases when polymorphic characters are included, statistical support also decreases. Tracing characters on the cladogram demonstrates that the increase in homoplasy, as indicated by support statistics, is actually "soft homoplasy" that results from frequency changes and independent character fixation from polymorphic ancestors rather than true convergence or reversal. These changes in character state frequency go unseen when small sample sizes are used or polymorphic characters are not scored as such.

The early modern human mosaic.

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Paleoanthropology has established that modern human morphology emerged in eastern Africa ca.150 ka BP, experienced a temporary ecozonal expansion ca.100 ka BP into southwestern Asia, spread through sub-Saharan Africa between 50 and 100 ka BP, and then spread through north Africa and Eurasia between ca.50 and ca.30 ka BP. What remains debated are the degrees of reproductive interaction between early modern and late archaic humans during this geographical dispersal.

The earliest modern human fossil sample remains small, scattered and fragmentary. However, assuming that the sample of Omo-Kibish, Herto, Qafzeh and Skhul represents the ancestral modern human morphological pattern, do the earliest modern humans in other regions possess archaic features absent in this sample?

Among early candidates for modernity elsewhere, there is an inconsistent mosaic of archaic and modern human features. This includes: projecting mentum osseum absence at Klasies River Mouth and Témara, mandibular robusticity at Nazlet Khater, wide mandibular rami at Nazlet Khater, Dar-es-Soltane and Oase, distal molar megadontia at Oase, juxtamastoid eminence prominence at Oase and Mladeč, distal limb foreshortening at Lagar Velho, maxillary central incisor shoveling in the European early Upper Paleolithic and across Asia, scapular dorsal sulci at Dolní Věstonice and Předmostí, clavicular elongation at Sunghir, south Asian dental morphology at Fa Hien and Batadomba-lena, Australomelanesian facial morphology at Niah, Moh Khiew and Tabon, and a suprainiac fossa at Pinza-Abu. This mosaic indicates that intermixture between regional archaic humans and geographically expanding modern humans was neither rare nor trivial. It was the dominant pattern.

Identifying the origin of Wari trophy heads in the ancient Andes using bioarchaeology and archaeological chemistry.

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Human trophy heads have been recovered archaeologically from several world regions, often provoking questions regarding their origins: are they derived from victims of warfare or were they venerated ancestors? We address this question through a case study of Wari trophy heads (AD 550-1000) recovered from a ritual structure at the site of Conchopata in the central Peruvian Andes. By examining the strontium isotope ratios of their tooth enamel and bone, we determine if the trophy heads represent locals or foreigners. The strontium isotope ratio from tooth enamel and bone reveals the geological zone from which foods were consumed during childhood and adulthood, respectively. Thus, if the strontium isotope ratios from trophy heads do not match that of the local geologic region, then it may be suggested that trophy heads represent foreign individuals and not local ancestors.

Results show that all individuals sampled from the mortuary sector (n=6) exhibit local strontium isotope values, as determined through strontium isotope analysis of modern fauna from Ayacucho and from published geologic reports. All of those burials contained local ceramics and local cranial treatment. In contrast, three of five trophy heads sampled exhibit non-local strontium isotope ratios. This suggests that, at least in some cases, trophy heads represent foreign victims, not local ancestors. Given associated iconography showing suspended trophy heads and 'captives' with hands tied behind the back, it is possible that the non-local persons represent those taken in warfare or raids.

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Isotopic reconstruction of paleodiet and immigration at Machu Picchu, Peru: early results.

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An important and elusive variable in skeletal populations is the degree of non-local immigration among their constituents. In addition to indirect measures such as ethnohistorical data, grave accompaniments and cranial markers of relatedness, stable isotope analyses provide direct, independent measures of migration during life. Carbon ($\delta^{13}C$), oxygen ($\delta^{18}O$) and strontium ($^{87}Sr/^{86}Sr$) isotopes in human tissues respectively reflect the isotopic composition of food, meteoric water and surrounding bedrock in one's place

of residence, thereby complementing other measures of immigration.

This study presents isotopic carbon, oxygen and strontium results from an ongoing study of the Inca population from Machu Picchu. Based on earlier analyses of burial contexts, this population is hypothesized to consist of *yanacona*, members of a heterogeneous servant class brought to the site from various regions of Peru. To independently test the hypothesis that these individuals are immigrants from multiple locales, enamel $\delta^{13}C$, $\delta^{18}O$ and $^{87}Sr/^{86}Sr$ from multiple teeth per individual (N=45) are analyzed in order to reconstruct patterns of residence at different developmental periods. $\delta^{18}O$ and $^{87}Sr/^{86}Sr$ data from faunal enamel (N=8) and drinking water from Machu Picchu are included as "local" baselines. Marked inter- and intra-individual variation in all isotopic measures was found, supporting hypotheses that this population included numerous immigrants to Machu Picchu. Patterns of dental wear, cranial deformation and skeletal pathology are differentially assessed among individuals grouped by each isotopic parameter. This approach sheds new light on status-linked migratory patterns in the Precolumbian Andes and highlights the importance of controlling for immigration in skeletal analysis.

Congenital limb malformation and a census of the Awajishima Japanese macaques.

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Since 1967, individuals with congenital limb malformations have been observed in the free-ranging group of Japanese macaques inhabiting the forests surrounding the Awajishima Monkey Center (AMC), on Awaji Island, Japan. In this paper, we present results from a true count census of the provisioned population, conducted over 8 weeks in July and August 2004. and discuss digital photography as a method for censusing provisioned groups. We also compare the incidence and severity of congenital limb malformation in the Awaji group to that reported in literature for primates. We identified all individuals in the group and documented their traits using digital photography, then compared these data with life history information collected by the operators of the AMC, as well as published demographic information on the population (Nakamichi et al., 1997; Yoshihiro et al., 1979). The provisioned population consisted of 199 animals, of whom 34 (17.1%) had some degree of limb malformation. Nineteen of the 34 monkeys with limb malformations were adults. While 25.0% of young males (aged 1-4) had limb malformations, only 11.1% of females in the same age group had malformations. For adults, the figures are closer, with 21.4% of adult males disabled compared to 19.4% of adult females. The incidence of limb malformation in this Awaji group is extremely high compared to that reported in the literature for other populations, and the cause remains unknown. We discuss the variance in age-sex distribution of limb malformations and implications disability may have for males and females in this female-philopatric species.

The taxonomic status of the fragmentary mandible, Sangiran 5 ("*Pithecanthropus dubius*"), Java, Indonesia.

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There are eleven known mandibular remains from the Lower and Middle Pleistocene of Java, all but one is from the Sangiran Dome region. All of these have been assigned to *Homo erectus* by most workers, whereas others have suggested that they represent as many as four different hominoid taxa (note: this is not the finding of this paper). In the case of Sangiran 5 even its hominid status is disputed. If it is indeed *Homo* it must be placed with the other "*H. meganthropus*" specimens. Here I provide detailed descriptions and comparisons with fossil hominids and great apes that show that Sangiran 5's size and morphology are well beyond the known range of any *H. erectus*. If it is indeed *Homo* it must be placed with the other *H. meganthropus* specimens. However these results may support the naming of a new species.

Two cases of metastatic cancer in a skeletal population from early medieval France: a bioarchaeological perspective.

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This study provides a differential diagnosis of two possible cases of metastatic cancer from the early Medieval cemetery (AD 500-800) of Saint Sauveur, France, and draws implications about environmental context and lifestyle.

The skeletal remains were examined macroscopically, microscopically, and radiographically. These analyses demonstrated mixed blastic and lytic lesions. Lytic lesions have no periosteal reaction around resorptive regions and tumorous cavitation occurs within trabecular bone followed by a subsequent breach of cortical bone. Histologically, the bones demonstrate neoplastic new woven bone formation around existing trabecular structure. These findings are consistent with cancerous lytic and blastic lesions. Affected bones include clavicle, scapula, ribs, humeri, femora and os coxae (vertebrae are absent). Bone metastases occur in 70% of modern cases of female breast cancer and most commonly affect the vertebrae, pelvis, ribs, femur, and skull with mixed lytic and blastic lesions, offering the suggestion that these two females may have suffered from familial breast cancer.

These cases are significant to bioarchaeological research because multiple cases of metastatic cancer in a preindustrial cemetery are rare. Familial cancer may explain the presence of these cases, but elevated levels of environmental carcinogens have been reported in response to Roman and medieval urbanization. Both of these factors may explain higher frequencies of carcinomas. This study considers both hereditary and environmental factors that may contribute to elevated incidence of cancer in the early medieval period in northern Europe.

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The toughness of foods selected by of four closely related Colobine species

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The texture of plant foods has been shown to influence food selection among primates. For this reason, studies of food mechanical properties add to our understanding of primate resource partitioning. This study investigates the toughness of high, medium and low priority leaves selected by four colobine species at the Endangered Primate Rescue Center (EPRC), Cuc Phuong National Park, Vietnam. Feeding observations of *Pygathrix nemaeus*, *P. cinerea*, *Trachypithecus delacouri*, and *T. laotum hatinhensis* permit inter- and intrageneric comparisons. Toughness data were collected using a portable field mechanical tester designed by Lucas et al (2001). We were able to present the primates with monospecific bundles of leaves found in their natural habitat due to the location of the EPRC in the primates' habitat country. Leaves exhibiting the lowest toughness values were preferred by each of the four primate species. The highest toughness values were obtained from foods of medium priority. *Pygathrix cinerea* (1305.9 Jm^{-2}) exploited the toughest medium priority leaves on average, followed in decreasing order by *T. delacouri* (1177.5 Jm^{-2}), *P. nemaeus* (1169.5 Jm^{-2}), and *T. l. hatinhensis* (1155.8 Jm^{-2}). However, no statisti-

cally significant differences were identified among the primates for leaf class or for the total diet. This suggests that these colobines may partition leaves according to other physical or chemical attributes.

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Infant socialization in bonobos (*Pan paniscus*): the influence of age, gender and maternal rank.

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Infant development significantly impacts the structure, cohesion, and adult behavior within primate groups. Diversity in infant socialization across the Order has been linked with many variables including dispersal patterns, habitat characteristics, nutritional requirements, predation, and dominance structure. For example, the bonobo *(Pan paniscus*) is a particularly interesting ape because of its close relationship with humans, the tendency for females to dominate males, and the presumed advantages given to offspring of high-ranking females. This paper presents data on the dynamics of infant socialization in a captive group of bonobos housed at the Columbus Zoo.

The bonobo colony includes four adult females, six adult males, two juvenile females and infants ranging from 1 to 30 months old. To test the hypotheses that (1) infant gender, (2) infant age and (3) maternal rank significantly impact the socialization process of infants, we studied the colony's social activity for 16 months. Using both scan and focal animal sampling methods, we quantified frequencies of play, grooming, touching, and sexual behavior for all infants as well as the social context.

Results from correspondence analysis indicate a strong correlation between age and rate of social interaction; as age increases the amount of interaction with other group members increases. We also found a strong correlation between infant gender and sociality. Surprisingly, we found no association between maternal rank and the nature or rate of infant social interactions. We conclude that maternal rank is a more dynamic aspect of bonobo sociality than previously thought.

Back to Medieval Évora (Portugal): confrontation of the human skeletal remains with the historical/archaeological records.

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At the historical city of Évora, a UNESCO world heritage centre, an archaeological excavation performed by the authors took place between 1996 and 1997 as an outcome of the requirement for the construction of a new basement in the Museu de Évora. This building is located between the Roman temple and the Cathedral built at the 12th – 13th centuries AD.

From the two field seasons, 21 graves were identified and 20 were excavated. The stratigraphy revealed three phases of occupation: an earlier Islamic one with three graves, with two adults and a juvenile; a Christian level, with 12 adults and two juveniles, some of them inhumed in anthropomorphic tombs; and finally a third level, with three adults, a juvenile and fragmented human remains recovered from five graves. Besides, a fetus was found under a tile.

In the current paper the results of the paleopathological and demographic analysis of these individuals are presented. The archaeological findings, namely spurs and buttons, relate the male individuals from the Christian level to the military Order of Évora (or *freires de Calatrava*) that took part at the Christian Conquest of Évora, according to the historical documents. The anthropological analysis supports this assumption: four adult individuals present traumatic lesions, affecting the skull and limb bones, and degenerative lesions related to occupational stress are frequent, namely those described as the horse riding syndrome.

This work shows the need of an interdisciplinary approach for the reconstruction of past human life, through the combined interpretation of human skeletal biology signs with historical sources.

Form, function, and body composition in gray langurs (*Presbytis (Semnopithecus) entellus*): a preliminary report.

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The folivorous-frugivorous Colobines represent a radiation of Old World monkeys with ruminant-like stomachs, distinct from the omnivorous cheek-pouched cercopithecines, the baboons, macaques and guenons. Gray langurs, widespread throughout the Indian subcontinent, are well known for some aspects of social behavior, but little for their locomotion and muscular anatomy. We analyze body composition of two adult females. We measured the stomach, intestines, and liver as 24.6% of body mass, with muscle at 23%; in contrast, the GI tract of macaques is 10-12%, and muscle 40% of total body mass (Grand 1977, AJPA). Almost 60% of langur muscle is concentrated in the lumbar region, hip, and thigh. Hindlimbs comprise only 15% of total body mass, (compared to the macaques' 24%), a body proportion masked by the langurs' heavy GI tract. Tail length exceeds that of body length and constitutes 2.6% of total body mass; in macaques, the tail is well below 1%.

From field observations during her research in Sri Lanka (then Ceylon), Suzanne Ripley (AJPA 1967) characterized langur posture and locomotion as acrobatic and flexible with running, walking, and leaping in trees and on the ground; macaques moved more cautiously and deliberately through the trees than the langurs. Our findings correlate muscle distribution, limb length, and tail mass with the locomotor breadth that Ripley described. The muscle-bone-joint relationships in langurs and macaques, graphically portrayed, clarify these comparisons.

Dental microwear texture analysis of primate molar wear facets.

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Dental microwear texture analysis has recently been proposed as a repeatable, objective alternative to conventional methods for quantifying microscopic usewear on teeth. This approach involves a combination of white-light confocal microscopy and scale-sensitive fractal analysis to characterize the texture of a microwear surface over a range of resolutions. Complexity, measured by area-scale analyses, and anisotropy, measured by variation in length-scale properties sampled at differing orientations have proved promising for distinguishing mammals with differing diets.

Here we present new data for an expanded baseline of living primates. Buccal facets on M_2s were analyzed using a white-light confocal microscope with a lateral sampling interval of 0.18 μm and a z-axis resolution of 5 nm over a region of 276 x 204 μm. Results indicate that *Cebus apella* and *Lophocebus albigena* evince greater fractal complexity, whereas *Alouatta palliata* and *Gorilla gorilla berengei* have more anisotropic surfaces. *Macaca fascicularis* and *Ateles belzebuth* are intermediate for both variables. These results correspond roughly to differences

in fracture properties of foods eaten by each taxon.

Here we also introduce a new variable, heterogeneity of complexity (HAsfc). HAsfc measures variation in texture across a wear surface at different scales. Preliminary results suggest that this variable may distinguish primates by the range of fracture properties of preferred foods. *Ateles belzebuth* for example, has HAsfc values lower than *Cebus apella* but higher than *Gorilla gorilla berengei*. HAsfc is a new tool for studying microwear texture that promises better resolution of the diets of early hominins and other fossil primates.

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Self-reported health status of contemporary Alaska Natives.

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Interviews from the 2001-2004 Behavioral Risk Factor Surveillance System (BRFSS) are used to evaluate the health and risk factors for American Indians and Alaska Natives (AI/AN) in Alaska relative to other races within and outside of the state. Alaska Natives continue to be at an increased risk for a majority of health behaviors. Relative to findings from the BRFSS for 1997-2000, Alaska Natives show no improvement in assessments of overall general health or prevalence of obesity and heavy drinking. The rate of cigarette smoking amongAlaska Natives is the highest for AI/AN and non-AI/AN of any region and has increased from the previous period. The 5% prevalence rate of diabetes among Alaska Natives approximates that of other races in Alaska and is significantly lower than the 12% average among all AI/AN in the United States. The changing picture of the health of Alaska Natives is assessed through self-reports of being told having diabetes, arthritis, and cardiovascular disease, cancer and HIV screening rates, and risk factors of high blood pressure, high cholesterol, tobacco use, alcohol use, and lack of physical activity.

Group composition and reproduction of Toque macaques (*Macaca sinica*) inhabiting the Udawattakelle Sanctuary, Sri Lanka

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The study was carried out from February 2001 to December 2002 in the Udawattakelle sanctuary, which is an important refuge for the endemic Toque macaque (*Macaca sinica*) in Kandy, Sri Lanka. During the study period seven troops were censused. Troop size ranged from 20 to 76 individuals with a mean of 37.7. On average troops comprised of 13% adult males, 30% adult females, 8% subadult males, 32% juveniles and 18% infants and approximately 58% of the individuals in a troop were sexually immature. Changes in the composition were caused by birth; recruitment of young animals into older age classes, migration of animals between troops, and death. Apart from the regular bisexual troops all-male troops ranging between 2 to 12 were also observed. Mating was observed from late September to end of March. Unlike in Polonnaruwa a birth peak was seen from March to September. Infant sex ratio was 1:1 but among adults there were twice as many females as males. Macaques regularly stray outside the sanctuary and cause extensive damage to human property, and so are treated as pests despite their endemic status.

Beyond brachiation: a spatio-temporal analysis of terrestrial locomotion of gibbons.

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Gibbons are widely known as excellent brachiators, but captive gibbons also commonly travel terrestrially, using bipedal, tripedal and quadrupedal gaits. To date, terrestrial gaits have only been described qualitatively (Baldwin and Teleki, 1976). This study aims to describe quantitatively all observed terrestrial gaits by analyzing footfall patterns and spatio-temporal gait parameters of gibbons over a large range of speeds.

Data is collected of five white-handed gibbons (*Hylobates lar*) during spontaneous terrestrial bouts on an outdoor island in the Animal Park of Planckendael, Belgium. The gibbons are filmed with a laterally positioned camera (50Hz). Digitization of the video images yielded duty factors, stride lengths and stride frequencies of the fore- and hind-limbs.

Based on the footfall patterns, we are able to distinguish seven different gait types, belonging to bipedalism, tripedalism or quadrupedalism. Although the footfall patterns of these gaits are clearly distinct, the relationships between their spatio-temporal parameters and velocity are largely similar. Importantly, the gaits are used in an overlapping range of velocities (0.6-3.0 m/s), in contrast to most other species where gaits are typically used at specific velocity ranges. Gibbons seem to choose 'randomly' which gait type they are going to use, and switch smoothly from one gait to another at virtually any speed. Gibbons are very versatile animals in which adaptations for brachiation do not appear to constrain terrestrial locomotor abilities. This paper gives insight into the locomotor capacities of gibbons, and, together with other studies on hominoid locomotion, it might contribute to the understanding of hominin locomotion.

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Population genetics of the catechol-O-methyltransferase (COMT) gene: insight into the evolution of human neurological and behavior-related disorders.

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Several studies have proposed that many of the common genetic disorders in human populations reflect genetic variation that was previously beneficial during human evolution but now results in detrimental effects in our current environment. Many neurological and behavior-related disorders are due to deficiency mutations in the catechol-O-methyltransferase (COMT) enzyme that plays a key role in the degradation of the neurotransmitters dopamine, epinephrine, and norepinephrine. Here we present the first population genetic analysis of the COMT gene in over 100 ethnically diverse humans originating from global populations of African, European, and Asian descent, as well as several great ape species, to explore the possibility that COMT enzyme variation for neurotransmitter regulation was historically an adaptive feature during human evolution. Our nucleotide sequence analysis of 10K base pairs of COMT finds a level of genetic variation within populations that is significantly greater than is typically found in the genome. Of particular interest is an amino acid mutation that is as high as 50% in human populations and which has previously been linked to decreased COMT activity, schizophrenia, and depression, but also increased sensitivity to sensory perception. The presence of high COMT genetic variation as well as the even distribution of this variation across global populations implies that COMT enzyme expression variation is not a recent phenomenon. Although much of this enzyme variation may be associated with neurological disorders today, our comparative genetic approach strongly suggests that this neurotransmitter genetic variation may have been highly adaptive

in regulating sensory perception during human evolution.

Austronesian and Papuan interactions in East Sepik Province, Papua New Guinea: A mtDNA analysis.

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Colonization of the Pacific occurred in two waves. By 35,000 BP humans first reached New Guinea, and settled all intervisible islands east to the Solomons, an area collectively known as Near Oceania. About 3,500 BP, a second culturally and genetically distinct intrusive group from Southeast Asia settled coastal Near Oceania, integrated their new components with indigenous materials, and gave rise to the Lapita cultural complex, before expanding east to previously unsettled Pacific islands, known as Remote Oceania. Genetically, the Sepik people today (either Papuan or Austronesian speakers) are the descendants of 3,500 years of interactions between these two groups.

In order to examine the relative influence of environmental similarity, geographic proximity, and language on gene flow, we analyzed the hypervariable region I of the mtDNA in 240 individuals from eight villages: Two villages in each of four environmental zones. Each village in a zone speaks a different language: one Austronesian, one Arapesh, two Abelam, and four Boiken—the last three are Papuan.

Language showed the strongest correlation with gene flow. The Boiken villages found across all four zones showed no significant genetic difference (average p=0.48). Two zones (ridge and coast) also showed high gene flow (p>0.51). In contrast, the Austronesian island village was significantly different to inland villages (p<0.09). We interpret the data to reflect a displacement across all zones by Boiken people moving from the Sepik Plain to the coast and islands, and little gene flow inland by Austronesians. These results are consistent with local oral histories and ethnographic accounts.

Character analysis using geometric morphometric data: the infraorbital region of early African fossil hominins.

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The methods proposed in Villmoare (2005) were applied to the infraorbital region of 48 *Pan troglodytes*, 43 *Pan paniscus*, 43 *Gorilla gorilla*, 47 *Pongo pygmaeus*, 50 modern *homo sapiens*, and 31 early African hominin fossil crania attributed to *Australopithecus arafensis*, *A. africanus*, A. *boisei*, *A. aethiopicus*, *A. robustus*, and early *Homo*. These methods, designed to determine discrete phylogenetic characters from geometric morphometric data, effectively identified many of the character states for characters that have been used in previous phylogenetic analyses of early hominins, from such studies as Skelton and McHenry 1992, Strait et al. 1997, Finarelli and Clyde 2004, and Strait and Grine 2004.

The protocol, which provides visual metric distributions of complex morphological variation, frequently offered greater resolution on character state variation than could be found in qualitative descriptions of the character data. In some cases, the geometric morphometric data contradicted previous descriptions of character states. But more notably, for several taxa, high degrees of variation were found to be present in some characters. This means that, for some characters, issues of polymorphism require revisions in the way characters of the infraorbital anatomy have been broken down into character states.

More technical conclusions can also be derived from this study. Most importantly, although 85 landmarks in the infraorbital region were collected, the most effective data sets were those that defined the anatomy of any given character with fewer landmarks. Although some complex anatomy required the use of many landmarks, in most cases using a minimal number avoided the statistical influence of variation in anatomy not at issue.

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Genetic differentiation among social groups of savannah baboons at Gombe National Park and Mikumi National Park, Tanzania: significance and relative contribution by age-class and sex.

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Classic models of evolution in subdivided populations do not consider the consequences of structure in the distribution of genotypes within demes. Such structure may be caused by clusters of individuals with correlated alleles. Clusters of individuals may be formed by sex-specific dispersal strategies such as natal dispersal and philopatry (demographic attributes common to many primate societies). Alternatively, a "breeding group" model of evolution presented previously by Chesser (1991) describes the distribution of genetic variation in populations characterized by sex-specific dispersal strategies. To test hypotheses generated by the breeding group model, we investigated the extent of genetic structure in 107 olive baboons (*Papio hamadryas anubis*) in Gombe National Park, and 96 yellow baboons (*Papio hamadryas cynocephalus*) in Mikumi National Park, Tanzania. Significant genetic differentiation among social groups is found in both Gombe (mean F_{ST} = 0.020-0.077, p< 0.00015) and Mikumi (mean F_{ST} = 0.006-0.039, p< 0.02851). These estimates are similar to recent published estimates of differentiation among African, European, East Asian, and Amerindian human populations sampled from different continents. However, the relative contribution of adult males, adult females, and offspring to genetic differentiation among groups in both Gombe and Mikumi differs considerably between both populations, contrary to expectations described by the breeding group model. We conclude that female philopatry exacerbates genetic drift in ways not predicted by classic models or by the breeding group model. Examination of the genetic consequences of sex-specific dispersal strategy may ultimately shed light on the exceptionally rapid evolution of the primate order.

Oh monkey, what a strong jaw you have: A preliminary comparison of symphyseal strength across monkeys, galagos and non-primate mammals.

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We currently categorize primates with mobile, ligamentous connections between the left and right dentaries as having unfused symphyses. Most living strepsirrhines are described as having unfused symphyses. Alternatively, species with a solid, bony connection between the two dentaries, such as living anthropoids, are described as having fused symphyses. In vivo data suggest the type and magnitude of symphyseal loading is correlated with these qualitative categories in primates. While morphological descriptions that fused symphyses are stronger than unfused symphyses correspond with experimental data, these qualitative rankings potentially confound the continuous variation in primate symphyseal strength.

To begin quantifying symphyseal properties, formalin-fixed jaws were attached to a Universal Testing Machine and

loaded to failure in either simulated wishboning (lateral transverse bending) or dorsoventral shear for individuals from seven anthropoid species (n=29), *Otolemur crassicaudatus* (n=3) and several non-primate mammals with unfused symphyses - treeshrews, cats, rats and ferrets (n=9).

Symphyseal strength ranges from 1.4kN in baboons to 11N in rats. Strength in wishboning is significantly correlated with body mass (r=0.98), while the correlation between body mass and dorsoventral shear strength only approaches significance (r=0.57, p=0.08). When scaled to symphyseal area, toothrow length or body mass, anthropoid species with their fused symphyses have significantly stronger symphyses than *O. crassicaudatus* and non-primate mammals with unfused symphyses (M-W U-tests).

Based on these preliminary results, in most cases qualitative categories appropriately distinguish variation in symphyseal strength, but significant insight into the continuous relationship between symphyseal form and load-resistance will be gained by quantifying symphyseal properties.

Early pregnancy loss as a reproductive strategy: evidence from a longitudinal study of Bolivian agropastoralists.

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Life history theory argues that organisms have evolved to allocate resources strategically between somatic and reproductive investments. Several authors have suggested that anovulation in women experiencing stress (whether energetic or psychosocial) is an adaptive response that temporarily prioritizes somatic and/or other reproductive investments (whether begun or future) over a new conception. By extension, pregnancy termination may also be an adaptive mechanism for reallocating resources in response to changing conditions.

To test this hypothesis, we evaluated the temporal pattern of early pregnancy loss (EPL) in an agropastoral population (Project REPA, *Reproduction and Ecology in Provincía Aroma*). Lack of concordance between energetically stressful seasons and EPL would argue for rejecting the hypothesis.

Representing 80% of the eligible participants in 30 rural communities, currently cycling women (n=191) were monitored longitudinally. Of 65 detected conceptions, there were 18 EPL, 40 SC (sustained conceptions), and 7 lost to follow-up. The distributions with respect to time of EPL and SC are significantly different ($p<0.003$). The probability that a conception will end in an EPL increases during: (1) the planting season, and (2) the end of the rainy season transitioning into the beginning of the harvest season. In both periods, food reserves are relatively low and labor demands are high.

While cytological studies demonstrate that genetic abnormalities are present in at least half of all EPL (Goddijn and Leschot 2000), these data support the hypothesis that the risk of EPL varies with ecological conditions. Whether this response to environmental stress is adaptive remains to be determined.

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Visual ontogeny and essential lipid levels in a small-scale society.

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Developing objective methods for measuring cognitive development and function among non-western peoples is important for investigating numerous issues including how variable ecological conditions, such as diet and disease, impact brain ontogeny. Small-scale societies can provide unique windows into these factors given their often-unique lifestyle patterns. Pattern-reversal visual evoked potentials (PR-VEP) – a standard tool in clinical neurology – offer an objective indicator of visual ontogeny and were collected among an age-representative sample of 171 Ache, forager-farmers of eastern Paraguay. Ontogenetic trends (cross-sectional) indicate that Ache visual development continues throughout late adolescence and into early adulthood followed by steady senescence across middle adulthood before rapidly senescing after age 60. Further, components of the human visual system – and particularly retinal and photoreceptor outer-segments – contain concentrated amounts of certain polyunsaturated essential fatty acids (EFA). Peri-natal and dietary levels of EFA have been variously linked to aspects of visual development and function. Total fatty acid levels assessed from mother's milk – broadly indicative of community nutritional status – are interpreted with relations among PR-VEP trends, lipid levels (including EFA components), and prior indications of elevated disease exposure among the Ache, considered within the context of life history theory.

A paleopathological perspective on coastal adaptations.

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The amenities of coastal environments are well known to modern tourists who flock to the world's beaches in enormous numbers. Archaeological data show that the coastal environments of the Western Hemisphere were among the first places Paleoindians colonized. Although coastal environments are ecologically diverse and offer many amenities to hunter-gatherers, they also present significant adaptive challenges that can have unhealthy consequences. Although marine resources are rich in protein, they are practically devoid of carbohydrates. Obtaining an adequate energy supply is a limiting factor for coastal populations. Costal environments are also topographically diverse with rugged cliffs and long stretches of flat beaches. As Charles Merbs noted in his ground breaking study of patterns of activity-induced pathology in a Canadian Inuit populations, such environments place heavy demands on the musculoskeletal system and can result in distinctive patterns of traumatic injuries and osteoarthritis. Coastal environments also harbor many pathogens that can have very harmful consequences for people who come in contact with them. These health challenges of coastal environments are illustrated by significant differences in the frequency of pathological lesion in the large series of skeletons (n=12,520) from coastal and inland sites studied as part of the History of Health in the Western Hemisphere Project.

Histomorphological variation in human auditory ossicles.

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Auditory ossicles represent bone specialized for transduction of sound, with diverse phylogenetic and embryological origins. Previous work (Greiner and Walker, AJPA Supplement 28:140) demonstrated that human auditory ossicles do not vary significantly between sides, nor between sexes. We now examine the microscopic anatomy of auditory ossicles in a series of modern humans. Within bone, Haversian remodeling is the response of bone tissue to imposed mechanical forces and external agencies, and reflects the forces to which bone is subjected during life. While the principal function of most bone is resistance of mechanical forces, the function of auditory ossicles is transmission of sound vibrations from tympanic membrane to inner ear. In this research we examine the histomorphology of auditory ossicles derived from a sample of modern humans of various geographic origins. The ossicles demonstrate unique morphologies compared to other human

lamellar bone. They are almost completely solid. There may be very small cavities in malleus and incus bodies. Vascular channels are very few, and there are no real identifiable secondary osteons. Processes of malleus and limbs of stapes are made of lamellae running longitudinal to their long axes. Bodies of incus and malleus give the appearance of being made up of disjointed fragments of lamellar bone. Lamellae in individual "fragments" are generally straight and parallel, but the lamellae in adjacent fragments meet one another at angles, from right angles to very oblique angles. The relationship of histomorphology of ossicles to their function and embryological origin is discussed. This research is supported in part by the NYCC Research Department.

Are there two human ontogenies? An investigation of growth trajectories among tropical foragers and farmers.

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This study investigates variation in body growth (cross-sectional height and weight velocity) among a sample of 20 small-scale societies. Intergroup variation tends to track environmental conditions with groups under less favorable conditions displaying slower growth and later puberty. However, the groups in our sample demonstrate considerable variation in developmental rates and timing that is correlated with rates of survivorship. For example, African "Pygmies", Philippine "Negritos" and the Hiwi of Venezuela are characterized by relatively fast child-juvenile growth for their adult body size despite less favorable conditions. In these societies subadult survival is low and puberty and menarche are relatively early suggesting selection pressure for accelerated development. In this faster developmental pattern, growth also tends to terminate early, especially for females, with an absent or diminished adolescent growth spurt. In sum, the origin and maintenance of different human ontogenies requires explanations invoking both environmental constraints and selective pressure.

Adaptive mutation in the mitochondrial DNA permitted humans to colonize the temperate zone and the Arctic, paving the way to the Americas.

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Human mitochondrial DNA (mtDNA) variation correlates dramatically with the geographic origins of indigenous peoples. This is a consequence of two factors: (1) the sequential accumulation of mutations along radiating maternal lineages as women migrated out-of-Africa and into the temperate and the arctic zones and (2) selection for those mtDNA variants that permitted people to adapt to the new climatic environments that they encountered during their migrations. This later influence on mtDNA variation is because the mitochondrial burn the calories in our diets with the oxygen that we breathe to generate energy for two major purposes: to generate ATP to do work and heat to maintain our body temperature at 37°C. Moreover, the mtDNA encodes 13 polypeptides that are essential components of the mitochondrial energy generating machinery, oxidative phosphorylation (OXPHOS), plus the rRNA and tRNA genes necessary for their expression. Consequently, as humans moved from tropical and sub-tropical Africa to temperate Eurasia and then arctic Siberia, mtDNA mutations which changed the energy balance for predominantly ATP in the tropics to more heat production in the arctic permitted the migrants to survive. As a consequence, as humans crossed each climatic transition, a very limited number of mtDNAs founded the mtDNA radiation in the new climatic zone. Specifically, only two mtDNAs (M and N) succeeded in leaving Africa and colonizing all of Eurasia and only three mtDNAs (A, C, and D) predominated in Paleolithic northeastern Siberia and thus colonized the Americas. Hence, environmental selection on mtDNA genetic variation has had a profound effect on human colonization of the globe.

Lateral excursion of the pelvis and the effect of leg-length.

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Experimental evidence has now established that longer legs induce more energetically efficient running and walking; it thus remains somewhat surprising that Australopithecines maintained relatively short legs for at least one millennia, despite population variation that would likely have allowed for the selection of energetically efficient longer lower limbs. Here I tested a possible selective advantage of shorter lower limbs. A series of individuals (N=12) walked on treadmill at the energetically optimal speed of 1.3 $m \cdot s^{-1}$ with a marker placed on their sacrum. The distance the marker moved laterally was recorded and analyzed and the results show that the individuals with absolutely shorter limbs experience a significantly smaller amount of lateral excursion of the pelvis than individuals with longer lower limbs ($p=0.015$). This suggests that the equations proposed by Rak (1991) in relation to vertical movement, are also experimentally true for medio-lateral excursion: shorter legs might be selected as a consequence of australopithecines' wider pelves in order to minimize the excursion of the pelvis during walking. Since increased excursion may lead to increased metabolic costs and has implications for the strength and development of hip-abductor muscles as well as the ability to carry loads, reduction of excursion can have significant evolutionary implications and might provide a reason for the retention of short legs by australopiths.

Fusion of craniofacial sutures in monkey skulls with special reference to the Finite Element Analysis

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Sutures are the boundaries where craniofacial bones meet and are important sites of skull growth and strain dampening. How sutural fusion affects craniofacial biomechanics and morphological adaptation in primates has not been studied extensively. No systematic data on patterns of sutural fusion in any primate species are available with concurrent information on sex and age. This study examined the status of twenty-eight sutures in rhesus monkey skulls from a collection of animals from Cayo Santiago Island, Puerto Rico, with known age and sex. Most animals died before all sutures fused. Variation was large in the age at which individual sutures or sutural sections were fused in rhesus monkeys, and there were significant differences in the amount of sutural fusion among functional regions and between males and females. Most fusion of sutures took place between ages 5 and 15. Sutures in the facial area tended to be less fused than in other areas. Adult males had more fusion than adult females, especially in the facial area. This might be explained by (1) differential biomechanical adaptations related to sexual dimorphism, or (2) differential aging processes, or (3) some combination of these factors in sutural tissues. These findings enrich our understanding of growth in primate craniofacial skeletons, and raise many questions concerning the relationship between processes of primate craniofacial growth, function, and evolutionary adaptation. Specifically, the inclusion of information on sutural mor-

phology in Finite Element Analyses will conceivably improve the accuracy and precision of functional analysis of various skull forms.

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Call structure of ringtailed (*Lemur catta*) and bamboo lemurs (*Hapalemur griseus*).

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Bamboo lemurs (*Hapalemur griseus)* and ringtailed lemurs (*Lemur catta*) are perhaps more closely related than their current taxonomy suggests. For example, these are the only two lemur taxa which exhibit wrist scent marking. If their scent communication system is similar, is the vocal communication system also similar in form? To these this hypothesis, we recorded 40 hours of calls produced by six ringtailed lemurs and three bamboo lemurs which range freely in a naturalistic forest habitat at the Lemur Conservation Foundation (Myakka City, FL). All calls were analyzed using PRAAT software to generate voice prints. The variables tested were maximum pitch, maximum intensity, and duration in 10 discrete calls for each taxa. The overall range of pitch for *L. catta* was 244.48 Hz to 1574.9 Hz, while the pitch range for the *H. griseus* was 137.26 Hz to 932.51 Hz. We found no significant overlap in the concentration of maximum pitch and intensity in nine of the calls analyzed. The exception is the "click-grunt" antipredator call which is structurally similar in intensity an duration for both taxa. This call appears to be mutually understood in the common habitat. We suggest that difference in the remainder of the repertoire can be related to how sound energy travels in the open often arid habitat of ringtails versus the swampy reed bed habitat of bamboo lemurs.

This research was supported in part by a Summer Fellowship for Women (TNW) and a General Research Grant (LLT) from the University of Miami.

Telling time with teeth: Determination of season at death using dental cementum increment analysis.

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Forensic anthropologists are called upon to estimate time since death in our analyses of human remains. We base our estimates on the condition of the remains, the presence of insect activity, and the decomposition microenvironment. Postmortem interval estimates are usually expressed as broad ranges of months or years. Dental cementum increment analysis has the potential to help us be much more specific.

Dental cementum anchors teeth into their sockets via the periodontal ligament. Increments are identified in the cementum deposits on the roots of human teeth, and under microscopic examination appear as alternating dark and light bands. Research with comparative samples of known-age and known date-of-death individuals has demonstrated a consistent relationship between annual seasons and the formation of distinct increment types. The winter, arrested cementum increment appears as an opaque band while the summer, growth increment appears as a translucent band. Together these represent one year of an individual's life. The total number of increments provides a means of determining the individual's age at death (Wittwer-Backofen 2004).

Zooarchaeologists have long used dental cementum increment analysis to estimate season at death in mammals (Pike-Tay 1991; Lubinski and O'Brien 2001), yet we are aware of no study that has tested this method in humans. The current pilot project seeks to identify the timing of increment formation in humans and thus provide a means by which season-of-death could be determined in forensic cases. Results of the pilot study by age group are presented here. The method appears most effective in middle to older aged adults, as the increments are more clearly identified, than in adolescents and early adults when some of the dentition has only recently erupted.

A reinterpretation of the paleoenvironments associated with Indonesian *Homo erectus* based on Bovid functional morphology.

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The Middle Pleistocene sites of Trinil and Kedung Brubus, Central Java, Indonesia have provided extensive faunal remains that are classified as part of a larger biostratigraphic framework. Paleoenvironmental reconstructions have previously been based on the composition and perceived shared habitat preference of fossil and modern animal taxa. Research of the African members of the family Bovidae has shown that a more effective way of examining past environments is through the study of morphological traits that are characteristic of functional adaptations to different environmental conditions. Although the previous studies utilize discriminant analysis to achieve habitat predictions, a thorough examination of discriminant analysis and recursive partitioning reveals that a combined parametric/nonparametric model produces the most accurate results for modern Bovid astragali from Southeast Asia. The current research represents the application of this new approach to the interpretation of the fossil Bovidae of Java. The results of this analysis indicate that the paleoenvironment of the Trinil site (ca. 1 Ma) was dominated by densely vegetated river valleys and upland forests, broken by open grasslands. These grasslands expanded during the period associated with the Kedung Brubus locality, approximately 0.8 Ma. This environmental change, coupled with the immigration of new species, was important to the appearance and future evolutionary success of *Homo erectus* during the Middle Pleistocene.

Intralimb length proportions in ancient North and South Americans.

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Intralimb proportions vary in human populations from different climates. Populations from colder climates tend to have shorter distal limb segments relative to the lengths of their proximal limb bones when compared with populations from warmer regions and this variation is presumed to represent long-term adaptations to local environmental conditions. While these ecogeographic patterns have generally been examined in human skeletons from Eurasia and Africa, studies of intralimb proportions and climatic variation have rarely included samples from across North and South America despite the geographic diversity and longevity of settlement in these continents. Using both original data collected by the authors and published data retrieved from other studies, we use analysis of variance to compare maximum lengths of the humerus, radius, femur, and tibia and brachial and crural indices in pre-Contact human skeletons (N=652) in sex-specific groups from tropical lowland and highland South and Central America and subtropical, temperate, and arctic North America to determine the degree of ecological diversity in these geographically widespread groups.

The shortest limbs and intralimb proportions are from the groups that inhabited the northern-most latitudes in North America and from the highest altitudes in South America. The longest limbs and intralimb proportions are from groups that inhabited mild climates in lowland South America and from temperate climates in southwestern and eastern North America. This variation in intralimb proportions suggests that climatic conditions, in addition to dietary variation and activity patterns, are important factors influencing body shape in ancient North and South Americans.

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Personality and subjective well-being in orangutans (*Pongo pygmaeus* and *Pongo abelii*).

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Orangutans are semi-solitary apes and our most distant hominoid ancestor. Raters assessed 147 zoo-housed orangutans in the United States, Canada, and Australia on 48 personality descriptors that were similar to questions used to rate human and chimpanzee personality. Of these orangutans, 135 were also rated on a 4-item subjective well-being questionnaire designed to resemble measures of subjective well-being in humans. The four items assessed an orangutan's balance of positive versus negative moods, happiness derived from social situations, ability to achieve goals, and a global measure of well-being.

Principal components analysis of the personality questionnaire yielded five reliable components: Extraversion, Dominance, Neuroticism, Agreeableness, and Intellect. Principal components analysis of the subjective well-being scale yielded a single component. Interrater reliabilities of both scales ranged from good to excellent. Correlations between the personality domains and subjective well-being revealed that, as in humans, Extraversion, Agreeableness, and low Neuroticism were related to the subjective well-being score. In addition, the pattern of correlations between the personality domains and four items making up the subjective well-being scale were consistent with the definitions of the personality dimensions and items. These findings suggest that analogues of human and chimpanzee personality and subjective well-being existed in the common ancestor of the extant great apes and recommend that individual differences in personality may influence the effectiveness of enrichment programs.

Developmental influences on upper limb asymmetry in a skeletal population from central California.

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Non-pathological asymmetry in human upper limbs is common due to development, handedness, and bipedality. The main support for activity causation of asymmetry in prior research included increase in asymmetry with age and differences between sexes. Age and sex differences, however, may be developmental rather than acquired.

This study examines age and sex differences in external metrics, muscle markers, osteoarthritis, and cross-sections of 131 (50 males, 69 females, 12 indeterminates) prehistoric California Amerinds aged from infancy to 50+ years to determine asymmetry patterns and their likely causes. Asymmetry variables are calculated using the formula [(large value-small value)/small value x 100], converted into *z*-scores, and correlated using nonparametric Spearman tests.
External metric asymmetry generally does not correlate with age. When sexes are combined, cross-sectional asymmetry does not correlate with age. Male cross-sections become more asymmetrical with age ($r = 0.35$; $P < 0.05$), but surprisingly female cross-sections become less asymmetrical with age ($r = -0.22$; $P < 0.08$). Muscle marker asymmetry generally increases with age (4 positive correlations; $r = 0.26$; $P < 0.05$), and is more statistically robust in males. Osteoarthritis asymmetry increases with age ($r = 0.25$; $P < 0.05$) in nearly all measures and in both sexes, but owing to sampling constraints is significant only in females ($r = 0.35$; $P < 0.05$). Especially for cross-sectional asymmetry, changes are most dramatic in young individuals, suggesting developmental asymmetry rather than acquired asymmetry. Further research, with large sample sizes and wide age distributions are needed to better understand the complexity of asymmetry.

An assessment of health from Florida's Archaic: application of the Western Hemisphere Health Index to the remains from Windover (8BR246).

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Windover (8BR46) represents one of the most ancient and well-preserved skeletal collections in North America. Excavated in the 1980s from a mortuary pond near Florida's eastern coast, the remains represent over 168 individuals, from neonates to elderly, enabling an evaluation of health at all stages of life. Through the application of the Western Hemisphere Health Index (Steckel and Rose, 2002), the overall health of the Windover population has been assessed and compared to populations utilizing various subsistence practices, in a variety of geographic regions spanning 7,000 years of human history. This assessment indicates a surprisingly low overall health score for a pre-agricultural population, with relatively elevated rates of trauma, anemia, and hypoplastic defects yet low incidences of dental and degenerative joint disease.
With a mean radiocarbon date of 7442BP, Windover comprises the oldest population yet assessed using this methodology, as well as the only population from Florida. The analysis also affords an evaluation of the methodology employed by the Western Hemisphere Health Index, assessing its strengths in standardization of protocol, size of data set, and ease of application as well as its weaknesses concerning transparency of score calculation and limitations in fracture assessment. The bioarchaeological assessment of Windover affords a rare glimpse into life and health during Florida's Archaic.

WLH 50 and variation amongst early Australian populations: implications for modern human origins.

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Advocates of the Multiregional model of modern human origins have consistently alleged that WLH 50 provides an example of an intermediate morphology between the Indonesian hominids from Ngandong and robust late Pleistocene Australians. These workers claim that features such as the supraorbital torus, nuchal torus, and cranial vault thickness provide evidence for genetic continuity in Australasia throughout the last million years. Critics of this view have argued that WLH 50 is not representative of early Australian populations, and instead is simply pathological.

In an effort to reexamine this question, we conducted an exhaustive survey of the available Willandra Lakes skeletal sample, including the specimens published by Webb (1989) as well as a number of unpublished individuals discovered more recently. Through this work we sought to examine whether WLH 50 fell outside the range of variation seen in that sample. In addition, we compared the morphologies found in this sample with those exhibited by the Ngandong sample.

Our results indicate that many of the characteristics of WLH 50, including the form of the brow ridge and nuchal torus, are quite similar to those found on other specimens in the WLH sample. However, these features are consistently unlike those found in the Ngandong fossils. In addition, the extreme thickness of the cranial vault in WLH 50 is unique in the sample, falling far above the range of the other WLH individuals as well as Indonesian *Homo erectus*. Thus, WLH 50 does not appear to represent an intermediate morphology.

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Functional relationship of lumbar lordosis and center of mass in the positional biomechanics of bipeds.

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Australopithecus and *Homo* share vertebral lumbar lordosis, a derived trait among primates. This spinal curvature is a proposed mechanism for efficient placement of total body center of mass (COM) over supporting hip joints. While a relationship between COM and lumbar lordosis in extinct hominins remains untestable, readily quantifiable postural and locomotor behaviors of pregnant human females provide a natural experiment for testing the prediction in modern bipeds.

Kinetic force-plate and 3-D positional data were collected from 20 healthy pregnant women during three gravid trimesters and a period post partum. Data were used to calculate angular segmental lumbar lordosis and fore-aft position of COM following integration introduced by Zatsiorsky and King (1998). Analyses of repeated measures ANOVA were performed. Results demonstrate significant increases in both the fore-aft position of maternal COM and the lumbar lordotic angle in second and third trimesters. A significant positional retreat of COM occurred post partum. Lumbar lordosis also significantly decreased post partum, although unlike the COM, the lordotic angle did not approximate first trimester values. Parity related shape remodeling in vertebral bodies and leverage compromise of abdominal muscles may have contributed to the more conservative reversal of lordotic angle. However, strong correlation and significant trends in both COM and lordosis associated with natural withdrawal of fetal mass supports a functional relationship between the two variables within modern humans and by inference more generally among hominins.

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Functional architecture of the brainstem trigeminal complex in two callitrichid species with divergent feeding behaviors (*Callithrix jacchus* and *Saguinus oedipus*).

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Callithrix jacchus and *Saguinus oedipus* are closely-related callitrichids with similar diets but divergent feeding behaviors. *C. jacchus* gouge trees to stimulate exudate flow, whereas *S.oedipus* feed opportunistically on gums. Previously, Taylor and colleagues showed that *C. jacchus* have relatively longer masseter and temporalis fibers, indicating enhanced muscle stretch capacity. They linked the longer fibers to wide jaw gapes generated by *C. jacchus* during gouging.

We are investigating the neurobiology of mastication in these taxa to assess possible differences in functional architecture of the neural systems governing mastication, and how such differences are related to divergent feeding behaviors. We began at the level of the brainstem trigeminal complex, focusing on cytoarchitecture of the trigeminal motor nucleus (which motivates masticatory muscles), and the mesencephalic trigeminal nucleus (which conveys signals related to jaw proprioception). Perfusion-fixed and post-mortem fixed brains of each species were frozen-sectioned transversely from the mid-medulla through the mesencephalon. To visualize the distribution of cell bodies and nuclear structures, sections were stained for Nissl substance with thionin or cresyl violet, and examined with compound microscopy and stereological tools.

Preliminary findings indicate little intertaxic difference in the motor nucleus, but possible differences in the complement and distribution of first-order sensory neurons in the mesencephalic nucleus. We are now investigating how differences in the mesencephalic nucleus might be functionally linked to masticatory muscle fiber architecture. We hypothesize that neural mechanisms subserving jaw proprioception may be critical components of the adaptations underlying tree-gouging in *C. jacchus*.

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An atmospheric re-enactment: implications for oxygen isotope use in paleoenvironmental reconstruction.

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Oxygen isotopes are of particular interest to paleoanthropologists because of their ability to provide information about past terrestrial environments. Hypotheses ranging from speciation causality to biomechanical advantage are often intertwined with paleoenvironmental and paleodietary reconstructions. The methodological application generally assumes that plants today operate much like plants of past times, yielding predictable fractionation values. However, some data suggest that plants in altered atmospheric conditions as may have occurred at times in human evolution may have a significantly different oxygen isotope fractionation from similar plants today. Because plant isotope values and the atmospheric conditions are reflected in the isotopic signatures of the physical material (i.e. fossil bone, tooth, shell, etc.) analyzed by current researchers of paleoenvironment and paleodiet, the relationship between atmospheric conditions and oxygen isotope fractionation values warrants further study.

This research quantifies the effect of altered CO_2 levels on the isotopic values of plants. I tested the hypothesis that plants of different photosynthetic pathways (C_3 vs. C_4) would respond differently to the CO_2 levels experienced during growth. Plants were grown from seed in chambers specifically designed to control the atmospheric environment, simulating the range of atmospheric differences throughout hominid evolution. Twenty individuals each of six species were grown to florescence during in summer, 2004. Plant oxygen was cryogenically extracted from plant water and analyzed using CO_2-equilibration methods. The results indicate that specific corrections should be made in interpreting ancient terrestrially-derived oxygen isotope values for paleoenvironmental reconstructions. Such application at key hominid sites can enhance the current interpretive framework.

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Pilgrimage to Byzantine St. Stephen's monastery: a dental metric perspective.

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Dental metrics were used to study migration to a Byzantine (5th-7thc. AD) monastery in Jerusalem. Tooth crown measurements were analyzed in conjunction with historical texts regarding pilgrimage to Byzantine Jerusalem. Mesiodistal (n=263) and buccolingual (n=485) measurements were collected for the mandibular and maxillary teeth. Teeth that were heavily worn, obscured by calculus, or chipped were not included in the study. Multiple measurements were taken by the first author to ensure low intra-observer error.

No significant difference was found between left and right teeth ($p \leq 0.05$). Comparison of the buccolingual diameters of the anchor teeth (I2, PM1, M1 in the mandible, I1, PM1, M1 in the maxilla) with 13 other collections from the southern Levant and Eurasia indicates that the monks bear resemblance to populations from the surrounding area, including the Roman-era site of Qumran and Bronze Age Jericho. The similarities to the Levantine collections corroborate previous non-metric dental studies (Ullinger 2002),

analyses of cranial and vertebral nonmetrics, as well as Sr isotope profiles and trace element data. The homogeneity of the group suggests that the monks originated in the Jerusalem area. Historical accounts indicate that pilgrimage to Byzantine Jerusalem was a major social phenomenon; the dental metric data do not support the textual record of St. Stephen's.

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Is *Papio robinsoni* or *Papio angusticeps* a better dietary ancestor for *Papio ursinus*?

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The robust facial morphology of Pleistocene *Papio robinsoni* is similar to modern *Papio ursinus* and dissimilar to Pleistocene *Papio angusticeps*. Meanwhile the two Pleistocene forms derive from sites of similar age; *P. robinsoni* predominates at Swartkrans, but is present at Bolt's Farm, and *P. angusticeps* is common at Cooper's Cave but is also found at Kromdraai. The prognathic muzzles of both *P. robinsoni* and *P. ursinus* may have arisen to process fall-back foods under deteriorating climate conditions. Alternatively, *P. angusticeps*, which exhibits a shortened muzzle and smaller teeth, may have existed in more stable habitats. We predicted the diet signal of *P. robinsoni* to be more similar to that of *P. ursinus* than it is to *P. angusticeps*. To test this hypothesis, the microwear scars on casts of dental impressions from *P. robinsoni* (n = 22, Swartkrans Member 1), *P. angusticeps* (n = 18, Cooper's and Kromdraai A) and *P. ursinus* (n = 27, Cape region) were compared using low magnification stereomicroscopy. Defraction of an external light source allowed for the characterization and quantification of pits and scratches located within a 0.4 mm by 0.4 mm sample area, defined by an ocular reticle. *P. angusticeps* and *P. robinsoni* both exhibited puncture pits, gauges and fine to coarse scratches that differed substantially from the large number of flake pits and hyper-coarse scratches characterizing *P. ursinus*. In contrast to our expectations, the diet signal of the two Pleistocene forms are much more similar to each other than either is to *P. ursinus*.

Investigating dietary change using the hair of ancient Inca mummies from Puruchuco-Huaquerones, Peru.

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As part of a larger project to study paleodiet on the central coast of Peru, hair from 59 mummified individuals was sampled for stable carbon and nitrogen isotope analysis. The objective of the hair study was to compare short term versus long term diet and to detect fluctuations that may be related to season or migration. Concomitant isotope data from bone were available for 57 of these individuals. Hair grows incrementally and represents a permanent isotopic signature of the growth period (1centimeter = 1 month of diet); whereas, bone in constantly remodeled over its lifetime and represents the average isotopic composition of diet over a longer period of time (10-25 years). For this study, the hair for each individual was cut into one centimeter increments in order to reconstruct the isotopic composition of monthly diet. Additionally, the entire length of hair was analyzed for its isotopic composition. When the isotopic composition of the entire hair length was compared to the isotopic composition of the corresponding bone collagen, the values were similar; indicating that diet in the months before death included similar food items as in the years before death. This was interpreted as evidence for population stability; the individuals buried at Puruchuco-Huaquerones were native to the coast. When the one centimeter increments of hair were analyzed, the isotopic composition varied considerably from month to month; indicating occasional incorporation of C_3 plants (e.g., tubers) and/or animals consuming C_3 resources. The monthly fluctuation in isotopic composition likely reflects seasonal fluctuations in resources.

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Dietary correlates of anemia in a young, urban, tribal population in Northeastern India.

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Iron deficiency is the most common nutritional deficiency in the world. Iron deficient anemia disproportionately affects women living in the developing world. Anemia has significant health consequences for women across the lifespan, including growth faltering, poor pregnancy outcomes, and decline in physical function. In most cases, the exact cause of anemia is unknown, though anemia has been associated with poor diet or presence of disease (infectious, chronic, or genetic). High rates of anemia have been reported in Indian populations; yet, anemia rates for most tribal populations in India are currently unknown. The Bhutia are one of the two government-recognized tribal populations living in the north eastern Indian state of Sikkim.

Unlike other Indian populations, the diet of Bhutia generally consists of foods with high amounts of bio-available iron, including beef. Beef is an important component of the Bhutia diet and most women reported eating beef on a daily basis. The goals of this study are to examine hemoglobin levels and to investigate the relationship between hemoglobin levels and the dietary patterns in young Bhutia women (25-35) living in the capital city of Gangtok. More than half of (53.7%) of the study participants were classified as anemic (hemoglobin levels < 12 g/dL). This rate of anemia is similar to the rates of anemia observed in other Indian populations. The relationship between beef consumption and other dietary components and hemoglobin levels are examined in this sample using a combination of 24 hour dietary recalls and food frequency checklists.

The effects of developmental and functional interactions on mouse cranial variability at different ages.

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Variability in the mammalian skull and its affect on the phenotype has long been of interest to physical anthropologists. In spite of this interest and the many studies devoted to measuring cranial variance in a variety of species, we have yet to determine the underlying factors producing this variance and the potentially different affects of these modulating factors through developmental time. In this study we test how particular developmental and functional interactions affect skull variability in the mouse and compare the relative importance of these interactions at different adult ages. Our sample consists of 50 crania of random bred mice aged 35, 90 and 150 days. 26 three-dimensional landmarks were collected from these skulls from reconstructed micro-computed tomography images. These landmarks were divided into subsets that outlined regions of the skull that have often been hypothesized to form developmental or functional modules. We measured and compared the degree of canalization, developmental stability and integration for each functional and developmental module for all three age groups. We predicted that canalization, developmental stability and integration would increase with age, and that most of the variance would be explained by functional modules. Our results indicate that there is no significant increase in variance or

integration with age, but there is a consistent pattern of both canalization and developmental stability for particular regions of the skull. These results suggest that variance is modulated through particular developmental and functional interactions. We discuss potential developmental and functional factors that may be involved.

Duration of exclusive breastfeeding and its relationship to childhood mortality among the Makushi Amerindians of Guyana.

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The WHO recommends exclusive breastfeeding (EBF) for the first six months of life primarily because of potential immunological benefits which are deemed to outweigh nutritive costs for infants. This recommendation is controversial as studies on the relation between duration of EBF and childhood health have produced conflicting results. Among the Makushi Amerindians of Guyana, recent developments are leading to an erosion of traditional breast feeding practices in favor of those advocated by the WHO. The objective of this paper is to compare mortality rates for children of Makushi mothers who practiced EBF for less than or more than six months. This analysis is based on recall data from 60 mothers. On average, informants were 40±10 years of age, had 7.5±3.0 children, practiced EBF for 5.8±2.8 months, and terminated breastfeeding at 19.6±6.7 months. Forty three percent of the informants practiced EBF for ≥6 months and, on average, had higher rates of childhood mortality than did those women who practiced EBF for <6 months. The difference, however, was not significant. Relative risk assessment demonstrates that those women who practice EBF ≥6 months had a 41% higher chance of losing a child between the ages of 1—5 years. Notably, this is occurring among mothers who are not energetically stressed. This study suggests that early supplementation may be beneficial for the infant. While recall data are problematic, these data are useful in revealing a pattern that warrants further investigation as WHO recommendations supplant traditional Makushi breastfeeding practices.

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The biological standard of living: An analysis of anthropometric data from the Swiss Army, 1865-1950.

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Welfare is a key research issue in social sciences. Anthropometric data - in particular body height - are increasingly used e.g., by the OECD, as "output"-predictor for the standard of living. The impact of environmental, especially economic factors on an individual's anthropometric parameters has been widely described before. Despite the fact that the data situation for Switzerland is better than for other countries, no interdisciplinary research on this topic has been done yet. The situation of Switzerland in this period is unique if compared to the rest of the world, given the remarkable political stability (federalist democracy) and cultural diversity (e.g., 4 languages within 200 km). Starting from low income levels in the second half of the 19th Century, the catch-up process to the industrialized leading countries was outstanding. In 1950, i.e. the end of our observation period, per capita GDP was higher than for any other European country (Maddison, 2001).

Anthropometric data of male conscripts (height, body mass, arm and chest circumferences) are linked to regional economic indicators (prices, inequality measures), agricultural production and income. In addition, we take individual physical ability records and social-cultural background information into account, as e.g., cultural diversity affects diet. Analyzing these time series revealed an additional methodological advantage: the data are unbiased, because of the fact that it is a draft army; up to 90 per cent of annual male birth cohorts are assessed.

Our results shed light on the relationship between a favorable economic environment and improved biological conditions.

The complex genetic landscape of Africa: a Y chromosome perspective

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Africa is a diverse continent with a long history of migrations. The recent expansions of Bantu-speaking farmers have had an extraordinary impact on linguistic, cultural, and biological variation in Africa. Despite the impact that Bantu farmers had on the African Y chromosome landscape, clear signals of demographic processes occurring before the Bantu expansions remain. In this study, we present Y-linked SNP and STR data suggesting that 1) Khoisan and Pygmy hunter-gatherer populations share a common ancestry that is not shared with agricultural populations 2) the earliest Niger-Congo speakers, from whom the Bantu are derived, likely descend from a relatively small number of males and 3) the fresh water lake regions may have acted both as a refugia for ancient haplogroups and a crossroads for populations carrying derived paternal lineages.

The Sorenson Molecular Genealogical Foundation (SMGF) and the construction of a publicly accessible genetic genealogical database.

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The Sorenson Molecular Genealogy Foundation has constructed, and is continuing to build, a large, correlated genetic and genealogical database for use in the verification and reconstruction of human genealogies over the last 10-12 generations. The database currently consists of approximately 60,000 DNA samples and corresponding genealogical data. The DNA data consists of 43 STR markers on the Y-chromosome, mtDNA sequence, both D-loop and complete mtGenome sequence, autosomal and X chromosome STR's. The genealogical data consists of four or more generations of names, birthdates, birthplaces and relationships for each proband. Genealogical information in the database have been merged to extend most of the genealogical lines beyond the four generations. Approximately 15,000 Y-chromosome STR haplotypes have been determined and are currently searchable on a publicly accessible database (www.smgf.org). mtDNA sequence, both D-loop and complete genomes, are currently in progress. Approximately 2 million autosomal STR genotypes have been produced. Algorithms for matching an merging genealogical data have been refined and population structuring based on genetic data performed.

The Delacour's langur in northern Vietnam: adaptations to a harsh environment.

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The Delacour's langur (*Trachypithecus delacouri*) is one of the world's most critically endangered primate species, with

only 270-302 individuals remaining in the wild. Survivors are endemic to forested limestone mountains of Northern Vietnam and are restricted to 19 small, isolated subpopulations in Ha Nam, Hoa Binh, Ninh Binh, and Thanh Hoa Provinces (Nadler et al., 2003). Van Long Nature Reserve, a 2643 hectare wetland reserve in Northern Vietnam, contains the largest of these remaining subpopulations, with about 80 individuals distributed in 8 groups across several rugged karst mountain chains covering 1784 hectares, for which the dominant vegetation is secondary forest on limestone.

During July 2005, ecological and behavioral research was conducted at Van Long, concentrating on two of these eight groups. Average group size is 15, with an average age/size group composition of one adult male, 6-9 adult females, 3-5 subadults, and 2 infants more than 4 months of age. Groups use sleeping caves at night. Eighteen soil samples were collected from karst microclimates to be analyzed for mineral content. Since its designation as a nature reserve in 2001, hunting of Delacour's langurs has ceased within the reserve and total population size has increased. Van Long's resident langur groups represent the most viable chance for species perpetuation and scientific study.

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Finite element analysis of craniofacial strain during incision and mastication using a macaque model.

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In vivo strain experiments have shown that, at several locations on the face, strain magnitudes and directions differ between anterior-tooth biting and cheek-tooth mastication. However, the available strain gage sites and experimental data are limited by the lack of precise control over bite point location. In this study we explore the influence of bite point location on the magnitude and pattern of strain in the face using a previously validated FE model of a *Macaca fascicularis* cranium. We test several hypotheses regarding relative strain magnitude and distribution in the face. Strain magnitude and direction in specific regions of the skull, including the rostrum, palate, postorbital bar, supraorbital torus and glenoid fossa of the temporomandibular joint are examined in detail.

Our findings demonstrate that modal shear strain throughout the face is highest during incision, when muscles are modeled based on EMG during incision and mastication. The most asymmetrical pattern of shear strain occurs during canine biting, while shear strain is most symmetrical about the face when biting with the anterior dentition or with the most distal molars. At every bite location strain decreases from the alveolar margin to the orbits, but the pattern of maximum shear strain decreases cranially in a less linear fashion on the working side during biting.

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Tail use during bipedalism in *Propithecus verreauxi*

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Bipedalism is rare among primates; only humans, hylobatids and indrids are exclusive bipeds when on the ground. Indrids, although phylogenetically distant, share with hominoids a number of behavioral and anatomical features including orthograde postures, large grasping halluces, loss of the tail in some groups, and use of bipedalism terrestrially. While *Indri* has almost completely lost its tail, the somewhat smaller *Propithecus* uses bipedalism regularly and possesses a tail (unique among primate bipeds). *Propithecus* and other leaping strepsirhines use their tails to induce body rotations during the aerial phase of vertical clinging and leaping (VCL) and for deceleration during landing, however it is unclear if the tail plays a role in bipedalism.

Here we describe the osteology and myology of the *Propithecus* tail and kinematics of the *Propithecus* tail during bipedal galloping. Radiographs and dissections illustrate that *Propithecus* possesses 25 tail vertebrae that increase in length from the most proximal to the 7th vertebra and then decrease in size to the tip. Muscle arrangements are similar to those in other leaping primates with tendons spanning 1-6 vertebrae. Tail kinematics during bipedalism were examined with respect to a theoretical model to assess the contribution of the tail to balance, propulsion, and rotation. *Propithecus* extends the tail at touch down and flexes it during take-off. Mediolateral movements are most prominent during lead limb switching. *Propithecus* tail function during bipedalism is similar to that during VCL, decelerating the body and rotating the hindlimbs into landing position and initiating rotations during lead limb switching.

This project was supported by the Jeffress Memorial Trust.

Do the number of daily jaw loading cycles help explain food resource partitioning among three sympatric species of *Hapalemur* in Ranomafana National Park, Madagascar?

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Behavioral observations show that three sympatric species of bamboo lemur (*Hapalemur simus, H.aureus*, and *H.g.griseus*) feed on different bamboo parts. Previous analyses indicated a size-correlated increase in maximal bite force generation and dietary mechanical properties among these three species, which differ in size. However, we observed interspecific overlap in maximum biting ability. This suggests individuals from a smaller species could mechanically break down foods eaten by the next larger species. Given overlapping, but on average dissimilar, biting abilities, we ask whether frequency-based differences related to repetitive daily loading might contribute to food resource partitioning.
We estimated the number of biting (oral preparation) and chewing cycles per day for each species from video taken in the field. Bites/chews per minute were averaged over several feeding bouts, then these values were multiplied by time spent feeding per day to estimate the daily number of biting/chewing cycles.

Preliminary estimates indicate all three species perform tens of thousands of bites/chews per day. Additionally, there is a size-correlated decrease in daily cycle number with the smaller *H.g.grisues* exhibiting the most bites/chews per day and *H.simus* the fewest. Given that certain individuals from smaller species 1) bite as hard as individuals from the next larger species and 2) bite/chew at least as frequently, it is unlikely that the number of repetitive loads by itself plays a key role in resource partitioning. Additional factors related to dental and/or jaw-muscle mechanical efficiency merit further consideration.

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The benefits of using faunal DNA for optimizing ancient DNA techniques.

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The field of ancient DNA has always faced two tremendous challenges: DNA degradation and sample contamination; efforts are still being made to develop more effective techniques to overcome these difficulties. Ancient faunal DNA can play a unique role in developing and optimizing such methods because of its intrinsic advantage over ancient human DNA, namely that modern human DNA from researchers and lab supplies can be effectively eliminated as a source of contamination for faunal remains through careful primer design. Since the DNA researcher can easily discriminate between modern human contamination and the authentic ancient faunal DNA, animals become an excellent proxy by which to monitor sample and lab contamination. We conducted a series of experiments using ancient DNA from whale, salmon, rabbit, sheep and goat to demonstrate their utility: 1) as proxy for human DNA preservation; 2) to monitor potential lab contamination by PCR products; 3) to evaluate the effectiveness of sample decontamination methods; 4) to evaluate the effectiveness of human contamination controls in the DNA lab. This study demonstrates how ancient faunal DNA analyses can benefit ancient human DNA studies.

Ecogeographic variation in human nasal passages.

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Nearly a century's worth of research into ecogeographic variation in external nasal morphology has shown that individuals from cold and/or dry climates tend to have tall, narrow noses, while individuals from hot and humid climates tend to have noses that are short and broad. This pattern of variation in external nasal anatomy is thought to be related to the amount of internal mucosal surface area relative to the volume of air within the nasal passages, but no one has explicitly demonstrated this relationship. Individuals whose ancestors evolved in colder, drier climates should possess higher surface-area-to-volume (SA/V) ratios than individuals whose ancestors evolved in warmer, more humid climates. A high SA/V ratio allows relatively more air to come in contact with the mucosa, thereby facilitating more efficient heat and moisture exchange, whereas a low SA/V ratio allows for better heat dissipation. To test this hypothesis, mucosal surface areas and nasal passage volumes were collected from a sample of CT scans of patients of European and African ancestry from the University of North Carolina Hospital as well as a sample of native South Africans from Johannesburg Hospital. Skeletal dimensions of the nasal aperture and nasal cavity were also measured to determine if they co-vary with SA/V. Results of this analysis indicate that individuals of European descent possess significantly higher SA/V ratios than both native Africans and individuals of African descent and that nasal aperture dimensions are correlated with SA/V, although not as highly as dimensions of the nasal cavity.

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Body mass distribution, forelimb kinematics and gait selection in primates: an experimental test of an evolutionary hypothesis.

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The kinematics of primate quadrupedal locomotion differ from the quadrupedal locomotion of other mammals in several ways. Most primates use diagonal sequence footfall patterns rather than lateral sequence footfall patterns. Additionally, primates walk with compliant forelimb kinematics, characterized by protracted arm postures at touchdown, pronounced elbow yield and long duty factors. These unique aspects of primate locomotor kinematics may stem from differences in body mass distribution along the craniocaudal axis. If the whole-body center of mass were positioned more caudally in primates than in other mammals, diagonal sequence gaits would arguably be more stable and the forelimb would be emancipated from its supporting function. We tested this hypothesis by measuring the gait kinematics of a female patas monkey (*Erythrocebus patas*) wearing a weighted belt (5-12% of the animal's body mass) strapped above the pectoral girdle – thereby shifting the position of the center of mass cranially – and compared these results to an unweighted control condition. Duty factor, limb phasing, limb yield and limb protraction angles were measured. If body mass distribution is responsible for primates' unusual gait, increased cranial mass should shift interlimb phasing toward a lateral sequence gait and reduce the use of compliant forelimb kinematics. Results indicate that although added weight caused significant increases in forelimb duty factor, gait selection and limb kinematics were unaffected. These results call into question the hypothesis that shifts in relative body mass may be responsible for the unusual gait kinematics of quadrupedal primates.

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Serial homology and the evolution of mammalian limb covariation structure: Implications for primate evolution.

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The tetrapod forelimb and hindlimb are serially homologous structures that share a broad range of developmental pathways responsible for their patterning and outgrowth. Here we assess a hierarchical model of limb covariation structure which is based on shared developmental factors between limbs. Because covariation can introduce constraints on the production of variation, we also test whether selection for morphologically divergent forelimbs or hindlimbs is associated with reduced covariation between limbs. Our sample includes primates, murines, a carnivoran, and a chiropteran that exhibit varying degrees of forelimb and hindlimb specialization, limb size divergence, and/or phylogenetic relatedness. We analyze the pattern and significance of between limb morphological covariation with linear distance data collected using standard morphometric techniques and analyzed by matrix correlations, eigenanalysis, and partial correlations. Results support a common limb covariation structure across these taxa that is consistent with shared developmental factors, and reduced covariation between limbs in non-quadruped species. These findings indicate that diversity in limb morphology has evolved without signficant modifications to a common covariation structure, but that the higher degree of functional limb divergence in bats and to some extent gibbons is associated with weaker integration between limbs. This conclusion supports the hypothesis that limb divergence, particularly selection for increased functional specialization, involves the reduction of developmental factors common to both limbs, thereby reducing covariation. We discuss the implications of this research for the evolution of primate limbs.

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Workloads and activity patterns of three ancient Egyptian populations.

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Musculoskeletal stress markers have been the subject of an increasing number of studies over the past decade. Other methods of reconstructing past life ways are augmented by MSM research in the Levant, North America, and Europe. Ancient Egypt has not yet seen the benefits

of this type of analysis save for one preliminary study (Zabecki 2005). In this paper, three samples from ancient Egypt are compared to investigate changing work patterns over time and place.

Fourteen muscle attachments on the proximal limbs of individuals from two Predynastic cemeteries (4000-3000 BC) and one Old Kingdom cemetery (2500-2200 BC) were scored using the Hawkey/Merbs (1995) scoring system for MSM. The data are approached in three ways in order to establish differences between sites: overall workload, male/female differences, and age group differences.

In general, the workloads of all three samples are on the low end of the scale compared with other populations from the literature. While differences between the three sites are not statistically significant, there is an obvious trend of increased habitual activity over time but a decrease in stressful activity (evidenced by enthesopathies). Males consistently show slightly higher scores than females, as is true with all other populations. Adult age groups show the most variance between sites, with different degrees of work displayed for each age group between the sites. Possible explanations for these phenomena are presented.

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Preliminary strontium ratio and nonmetric trait analysis from a Islamic Spanish Medieval assemblage.

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Little is known archaeologically about the Islamic conquest of Spain in AD 711. With the support of the local Imam, this is being rectified by the excavation and analysis of a large cemetery in Écija (located east of Sevilla on the Guadalquivir plain). The cemetery contains an estimated 6000 inhumations.

A series of 60 adult skeletons have been studied. Of these, 30 molar tooth samples were obtained from 20 individuals for strontium analysis. The samples selected dated to the earliest period of use of the cemetery as these may represent the initial Islamic migrants into Iberia, potentially made up of Berbers from North Africa. The initial trace element analysis reveals a range of strontium Sr-87/Sr-86 ratios for the individuals of 0.708187 to 0.708856, indicating that the individuals all resided in close proximity to one another during childhood.

High frequencies of both unilateral and bilateral septal apertures (single and multiple) and emarginate or notched patellae were found. Furthermore a single case of os japonicum was noted.

This paper compares these distinct data sets and places the results within the context of the archaeologically recognisable potential sources for the cemetery population.

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The interface of Human Biology and Medicine: applying concepts from human biology to growth interpretation in the clinical setting.

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Chronic diseases of childhood present extraordinary opportunities to examine unique aspects of human growth processes and the growth reponse to adverse conditions. In clinical care, the focus, by necessity is on the individual where these processes are difficult to detect. Yet, the concepts of plasticity, adaptive response, population variation, genetic potential, tempo and canalization have important clinical implications. In pediatrics, growth is used as a screening tool and a biomarker, and is sometimes among the first presentations of underlying disease (e.g., Crohn's disease, cystic fibrosis). In other cases, growth failure is accepted by clinicians as an unavoidable consequence of a chronic disease or its treatment, as evidenced by growth-specific growth charts (e.g., sickle cell disease). Examples from studies of children with a variety of disorders will be presented to show that: (1) growth failure is often a stress-response in chronic disease. Rarely is the "adaptive" benefit evaluated, but such information is sometimes essential to justify medical intervention ; (2) population variation and longitudinal patterns are important indicators of patterns and magnitude of growth disruption; (3) the concept of genetic potential is useful in demonstrating the magnitude of growth deficit but is rarely applied in clinical care; (4) both human biologists and physicians are poorly equipped to characterize growth tempo and the potential for catch-up growth.

MtDNA story of Turkic-speaking Altai populations: implication for the prehistory of Siberia.

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The Altai region of South-Central Siberia has been the focus of recent genetic research because of its being the putative source area not only for its many indigenous Siberian groups, but also for ancestral Native Americans. At present, a number of tribes occupy the northern slopes of the Altai Mountains and speak closely related Turkic languages. To assess their genetic structure and affinities with other native Siberian populations, we analyzed over 500 maternally unrelated individuals from the Southern and Northern Altaic language groups.

We found that mitochondrial genetic markers were significantly different in their distribution within Altaian groups, with the frequency of Eastern European haplogroups varying from ~55% in Chelkans to about 80% in Tubalars and Altai-kizhis. Although having a substantial 'Turkic' genetic heritage, the phylogeographic stratification of individual mtDNA haplotypes from the Tubalars and Altai-kizhi suggested their putative genetic links with the geographically distant Northern Samoyed-speaking populations and Paleoasiatic linguistic group of Kamchatka Peninsula. We believe that a common contact zone may have existed in the forest-steppe belt of ancient Siberia during the Last Glacial Maximum. Its presence would have allowed genetic exchange between many early Paleolithic groups, with the subsequent spread of languages in most recent times. The sharing of common ancestral genetic variants between linguistically distant populations indicates the importance of grouping separate language families in only their linguistic contexts. It further highlights the fact that population histories inferred from archeological, cultural, or linguistic evidence do not necessarily overlap with those drawn from genetic data.

Skeletal and muscular comparison of adult female chimpanzees (*Pan troglodytes*) and orangutan (*Pongo pygmaeus*).

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Chimpanzees and orangutans exhibit similar locomotor abilities but with different emphases: chimpanzees through propulsive weight-bearing during quadrupedal locomotion, orangutans through climbing strength of long and flexible forelimbs. Their locomotor preferences correlate with bone and joint morphology, soft tissue anatomy, and muscle and body mass. Our findings are built up from whole body dissections on two adult female chimpanzees and an adult female orangutan. Chimpanzees have a relatively long pelvis, femur, and short foot. Orangutans have a relatively long clavicle, humerus, radius, ulna, and hand, and a long foot equal to the length of the femur. The relatively heavy chimpanzee hindlimbs

reach 20% of total body mass compared to the orangutan's 12.3%; chimpanzee forelimbs fall at 16%, orangutans at 18%. Muscle proportions and attachments underlie the flexibility of orangutan joints, for example, the absence of a ligamentum teres in the hip joint is unlike any other anthropoid. The chimpanzees' more massive quadriceps femoris and less massive hamstrings attach closer to the knee joint, in contrast to the orangutan's more massive hamstrings that attach lower on the tibia, thus increasing their rotational action. This report illustrates muscle, bone, and joint relationships and contrasts the locomotor adaptations of these two great apes.

The genetic structure of the Aleuts and circumarctic populations and its implications for the peopling of North America.

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The mtDNA variation for 198 Aleuts, as well as North American and Asian populations, were analyzed to reconstruct the Aleuts' genetic prehistory and to investigate their role in the peopling of the Circumarctic region. The Aleut mtDNAs were found to be consistent with the Circumarctic pattern by the fixation of subhaplogroups A3 and D2, and the exhibition of depressed diversity levels relative to Amerind and Siberian groups. Median-joining network analysis revealed three star-like clusters in the Aleut sample. Corresponding mismatch distributions, neutrality test scores, and coalescent date estimates for the identified clusters provide evidence of two expansion events, one occurring at approximately 19,900 B.P. and the other at 5,400 B.P Based on these findings and evidence from the archaeological record, four general models for the genetic prehistory of the Aleutian archipelago are proposed: 1) biological continuity involving a kin-structured peopling of the island chain; 2) intrusion and expansion of a non-native biface-producing population; 3) amalgamation of Arctic Small Tool tradition (ASTt) peoples characterized by subhaplogroup D2 with an older Anangula genetic substratum; and 4) biological continuity with significant gene flow from neighboring populations of the Alaskan mainland and Kodiak Island. Overall, the results of this study indicate a broad postglacial reexpansion of Na-Dene and Esko-Aleuts from reduced populations within northern North America, with D2 representing a later infusion of Siberian mtDNAs into the Beringian gene pool.

"Meta-analysis" of Pubmed®-listed scientific studies performed on Ancient Egyptian mummies.

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Scientific studies of ancient Egyptian mummies have a long history, especially since the application of x-ray based methods (König, 1896). Yet, a "meta-analytic" review (a systematic and quantitative research tool as applied e.g. in evidence-based medicine) of modern paleopathological studies on such mummies has never been done before. The aim of our project is to analyze Pubmed®-listed studies - as carried out on ancient Egyptian mummies / mummified tissue - by medical and Egyptological criteria.

All paleopathologic studies of mummies performed since 1977- the year of the first application of computed tomography (CT) on mummified tissue (Lewin and Harwood-Nash, 1977) - have been included. To maintain established scientific quality standards, only studies published in Pubmed® (U.S. National Library of Medicine database of biomedicine) have been considered (n=73). Criteria to be reviewed include e.g., place of study, examination methods used or type of mummification of the mummy.

The quality of the published data is unexpectedly heterogenic; e.g. in terms of account details of examination methods used or provenience information of a particular mummy. In 48% of all studies the sex of the particular mummy was either not listed or doubtful. On the other hand, the historic age is listed in 92% of all reports. A total of 29% of all studies have a US origin.

This project helps to summarize and qualitatively validate the hitherto quite disperse paleopathologic information in this important field of research. Any feedback (e.g. additional references) is most welcome and shall be directed to: frank.ruhli@anatom.unizh.ch.