Mitral dribble flexibility in ape foot dynamics, early hominid footprints and bipedalism. D.J. MELDRUM, Dept. Biological Sciences, Idaho State University, Pocatello, ID 83209-8007. R.E. WUNDERLICH, Center for Locomotion Studies, Penn State University, University Park, PA 16802.

As early as 1935, Eifman & Manter noted the mitral dribble flexibility present in chimpanzees and contrasted it with the comparatively rigid platform of the human foot. The dorsiflexion of the heel segment at the transverse tarsal joint was referred to as the "mitral dribble." It permits the independent actions of the grasping forefoot and the levering hindfoot during climbing. At some point after the transition to habitual bipedalism, the ape grasp-climb adaptation and midfoot flexibility were lost, thereby increasing the mechanical advantage of the ankle plantarflexors. This improved the efficiency and economy of distance walking and running. Others have subsequently made note of this distinction of the ape foot, but the kinesinetics and correlated tarsal relationships of the midtarsal break have received limited consideration.

We set out to characterize the midtarsal break using several methods. We videographed two chimpanzees and humans during bipedal and quadrupedal (chimpanzee) locomotion with simultaneous lateral, plantar and fore-aft views and recorded the distribution and magnitude of plantar pressures. Lateral and A-P radiographs of the foot of one anesthetized chimpanzee were used to visualize tarsal relationships through the range of midfoot movements. Ape and human footprints were examined to document the potential effects of a midtarsal break on footprint configuration.

During stance phase of chimpanzee bipedalism and bipedalism, a pronounced dorsiflexion of the hindfoot accompanies high midfoot peak plantar pressures, relative to those observed in human bipedalism. Radiographs indicate that the flexion of the midtarsal region occurs primarily at the talonavicular joint and to a lesser degree at the calcaneocuboid joint. High midfoot pressures during the midtarsal break are often indicated by a pressure ridge in chimpanzee footprints, not observed in human prints. Our data provide a novel perspective on the interpretation of the often controversial Laetoli trackway, the oldest direct evidence of hominid bipedalism. Preliminary examination suggests evidence of a relatively ape-like midtarsal flexibility and the lack of a consistently present longitudinal arch.

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Mitochondrial DNA D-loop sequence variation within and between Yanomami villages. D. A. MERRIWETHER (Michigan), K. Green (Michigan), D. E. Crews (Ohio State), and J. V. NEEL (Michigan)

Blood was drawn on over 3000 Yanomami from 52 villages in Brazil between 1966 and 1976 by the Neel lab, and from 100 individuals from ten Yanomami villages in the 1990s by the Crews lab. DNA was extracted over the last three years, and mtDNA and Y chromosome typing has proceeded on the unrelated individuals from this sample. Mitochondrial DNA D-Loop sequence variation (nts 15975-00048 and 00080-00430 were amplified and sequenced in both directions on an ABI 377XL automated sequencer) was collected and examined in a subset of these villages and samples. Expansion times (using pairwise sequence distance distributions), gene flow (using Maddison and Slatkin's cladistic approach), and heterozygosity were examined in this subset. The Yanomami prove to be quite variable, both within villages, with many mitochondrial haplotypes observed, and between villages (where haplotype frequencies and private polymorphisms vary from village to village). The patterns of variation is contrasted with the genealogical structures of the villages.

We also show preliminary data on Testes Specific Protein Y (TSPY) variation in the Yanomami. The TSPY gene has proven to be quite polymorphic in humans, providing a good model for studying within-population Y-chromosome variation. Previously only short tandem repeat polymorphisms were polymorphic enough for examining within population variation. Since STRs are often phylogenetically uninformative due to the high level of homoplasy, it is preferable to find a more discrete system with a lower forward/backward mutation rate, such as is described here. We present sequence variation from 780 ma of the first intron (and flanking exonic sequence) of the TSPY gene from a random sample of unrelated Yanomami.

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Sexual dimorphism in the modern human femur: Application of linear and areal data. K.A. METZGER, C. LACOSTE, Department of Anthropology, University of California, Santa Cruz, Santa Cruz, CA 95064.

Previous studies of sexual determination and sexual dimorphism of the human femur have generally focused
solely upon linear data taken directly off of bone (Black, 1978; DiBennardo and Taylor, 1979; MacLaughlin and Bruce, 1983). In this study, linear data are combined with photographic areal measurements in order to provide a novel approach to the study of sexual dimorphism. In addition to expanding the range of possible measurements, such an approach allows for insight into dimorphism as it relates to muscle attachment sites on the bone.

A sample of 107 male and female femora was chosen from the Terry and W. Montague Cobb Collections in Washington, D.C. All individuals were designated as Caucasian and had completed femoral growth. Nine linear measurements as well as photographs of a standardized posterior aspect were taken and all photographs were digitized. In order to analyze areas of muscle attachment representing different muscle groups, standardized digital manipulations were made on the photographs and UTHSCSA ImageTool™ was used to quantify areas.

Statistical testing conducted to determine differences in univariate measurements from the Terry and W. Montague Cobb Collections showed no significant differences with a confidence level of 99%. A similar analysis showed no significant differences among individuals in different age groups. Univariate and multivariate analysis of linear measurements indicated that femoral head diameter was the most accurate predictor of sex, producing correct discrimination 86.9% of the time. Additionally, femoral collog-diaphyseal angle was not statistically different between males and females (z = 0.01).

Analysis of areal measurements provided discrimination percentages of lesser utility. However, it also indicated that male and female femoral morphologies showed very few differences in ratios of areas of muscle attachment.

Proportions of attachment sites in all measured areas were not statistically different, suggesting that any variance seen between males and females was confined solely to factors relating to size as opposed to ones of proportionality.

Enamel microdefects in a modern sample. L.M. MIFSUD and M.K. MARKS, Department of Anthropology, University of Tennessee, Knoxville, TN 37996

Developmental defects in tooth enamel (Wilson bands) have been routinely utilized by bioarchaeologists to ascertain prehistoric and historic fetal/maternal, infant and childhood morbidity. Wilson bands have been employed to develop inter-/intra-tooth chronology, underscore temporal relationships, and measured against other non-specific dental and skeletal stress indicators.

While hypoplasias are assignable within contemporary groups and their frequencies readily related to clinical events associated with sub-standard existence, microdefect patterns among such groups are unstudied and questions remain regarding chronology, sensitivity and distribution.

Teeth (N = 237) were donated by African- and European-American patients from ten public health clinics and oral surgeons’ offices in Tennessee and California. Age, sex, and socioeconomic background were provided focusing on mandibular canines and maxillary central incisors. Like previous prehistoric research, these Wilson band frequencies indicate much greater sensitivity than enamel hypoplasias.

Similar to that research, first, second and third year frequencies were 1, 76 and 17%, respectively, which is common finding traditionally associated with weaning cycles. However, unlike previous findings, incisor and canine were equally susceptible to Wilson band development.

Finally, there is an obvious negative correlation between socioeconomic status and Wilson bands. Yet, regardless of socioeconomic, European-Americans displayed a significantly greater morbidity frequency compared to African-Americans (4%). This project not only confirms previous research on prehistoric samples but addresses demographic concerns involving differential susceptibility in living groups regardless of economic challenges that affect health.